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(REGISTERED AS A NEWSPAPER.)
FOUNDED, 1892.

PRICE ONE SHILLING

JANUARY 13, 1916
Vol. XXXIX., No. 3
WITH
"MOTOR TRAFFIC" SECTION

716754

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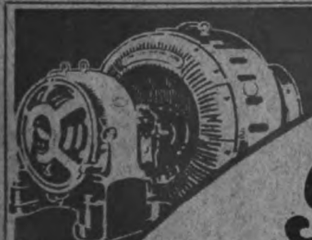

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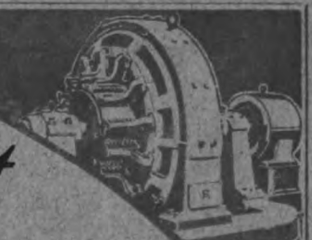

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1916

LONDON:

THE TRAMWAY AND RAILWAY WORLD PUBLISHING COMPANY, LIMITED,

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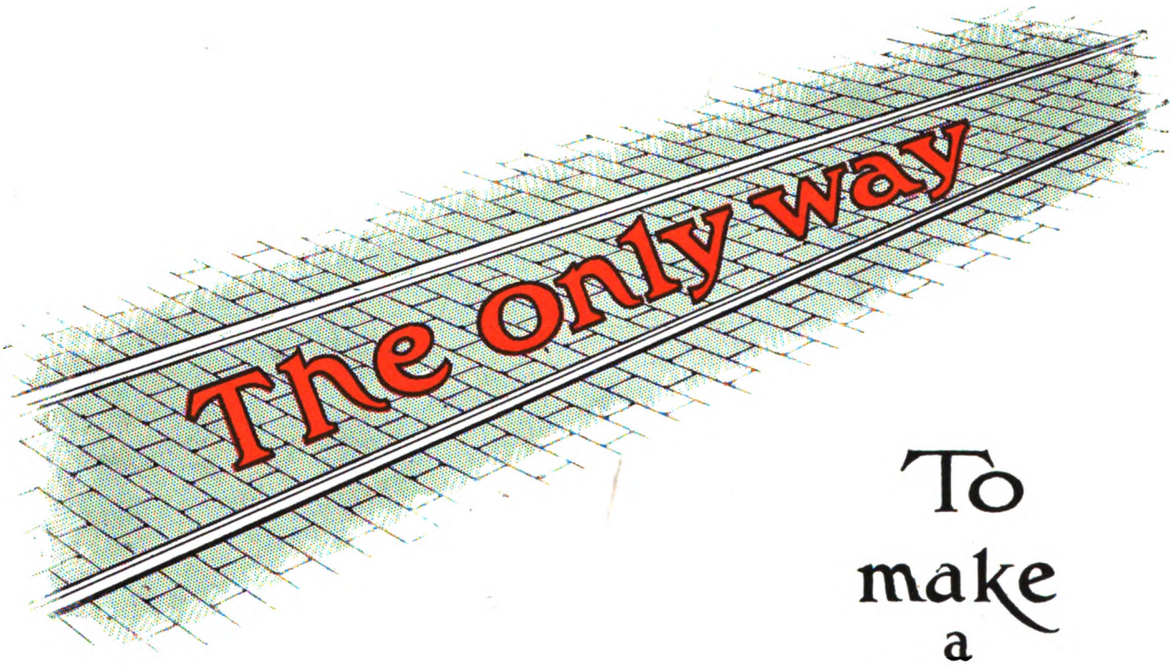

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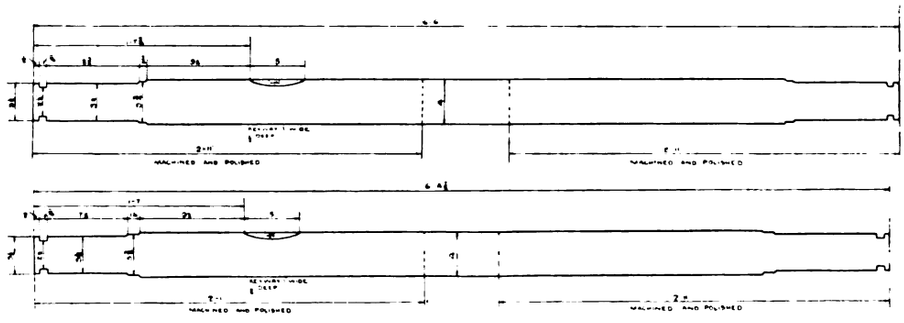

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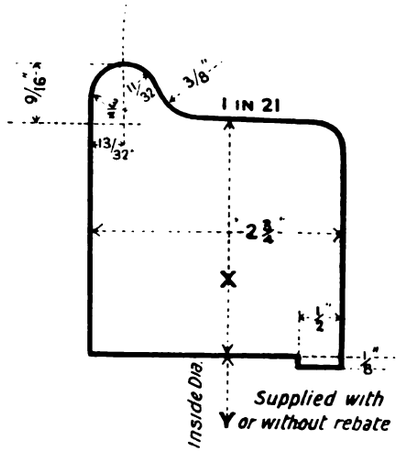

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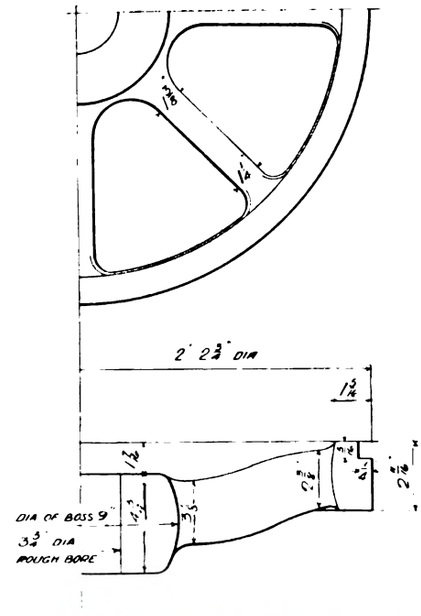

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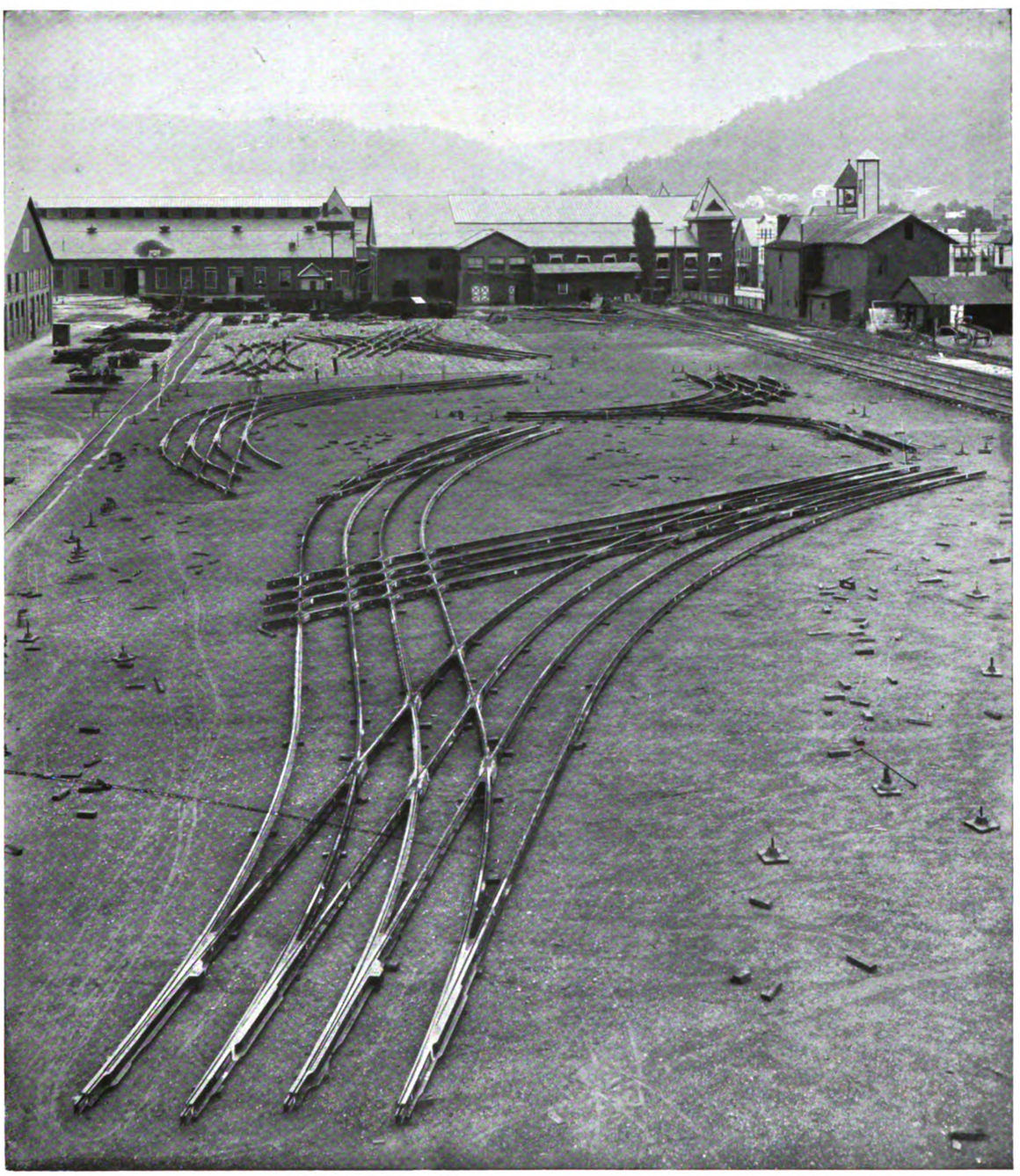

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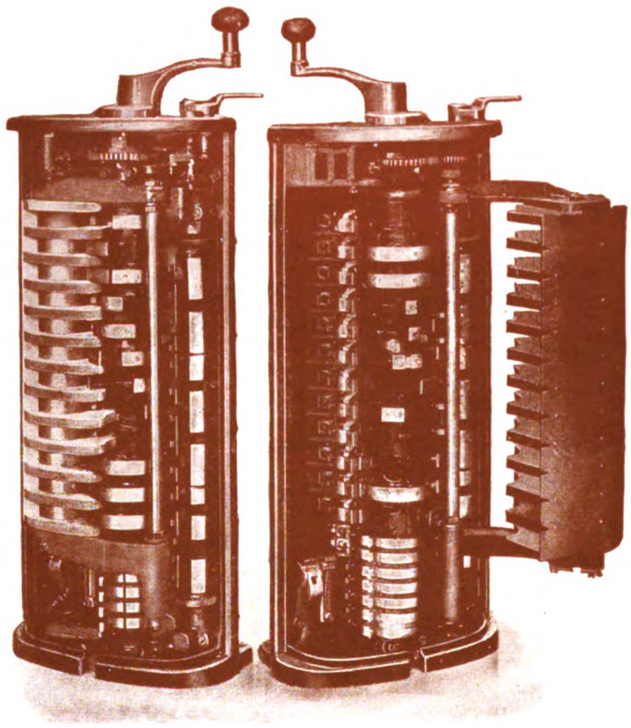

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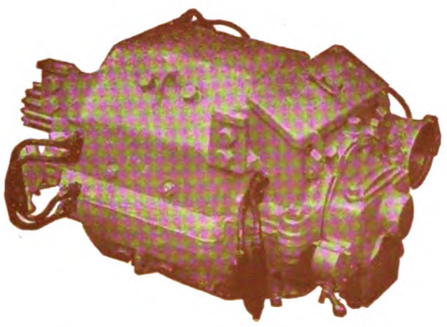

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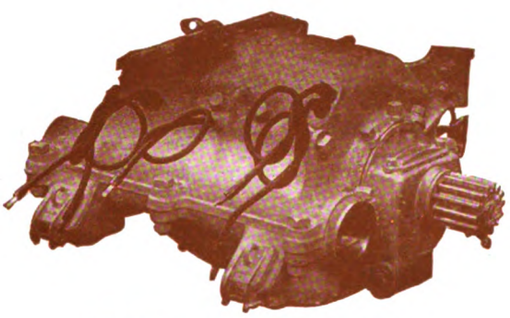

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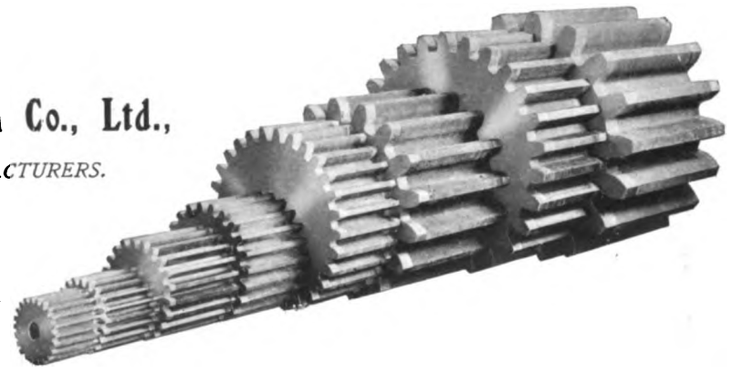

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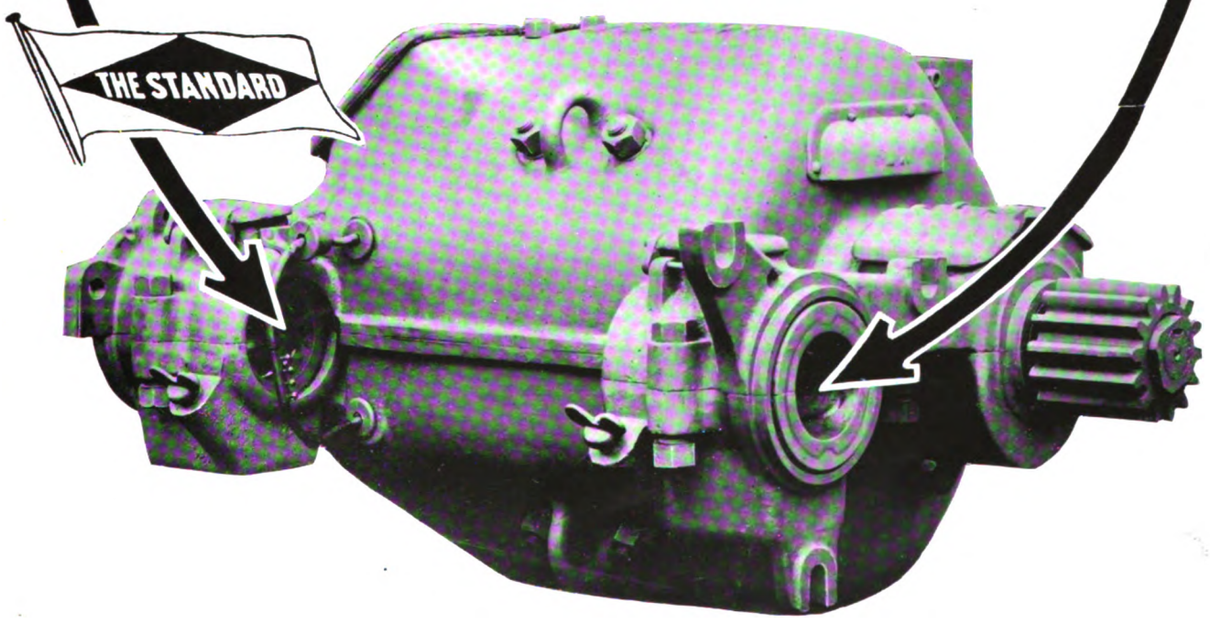

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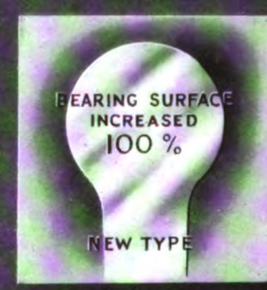

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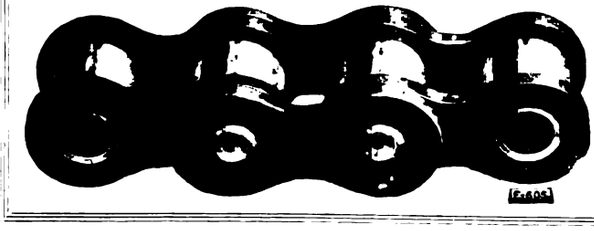

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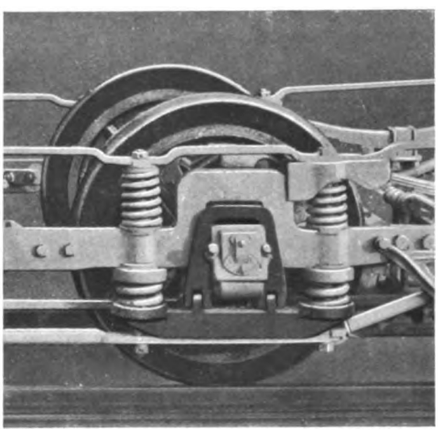

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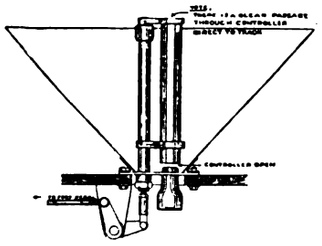

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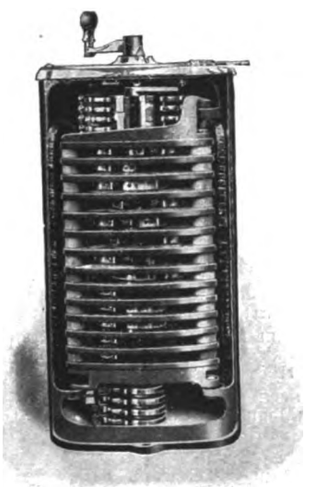

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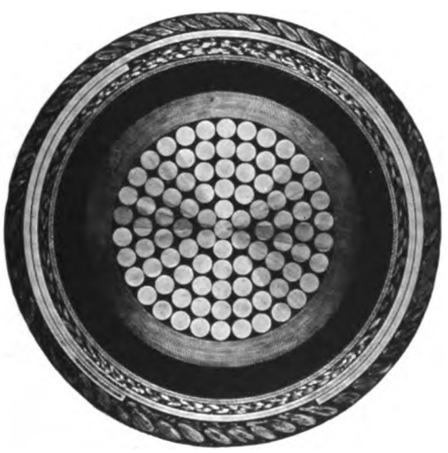

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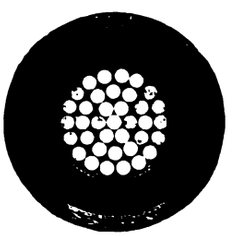

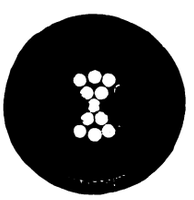

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The Editorial and Publishing Offices of "The Tramway and Railway World" are at Amberley House, Norfolk Street, London, W.C.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, JANUARY 13, 1916. Vol. XXXIX.

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LANCASHIRE AND YORKSHIRE RAILWAY ELECTRIFICATION.

MANCHESTER TO BURY SECTION EQUIPPED WITH DIRECT-CURRENT SYSTEM AT 1,200 VOLTS.

Marked improvements have been made from time to time by the Lancashire and Yorkshire Railway in the conveyance of passengers quickly and comfortably by the introduction of electrically-propelled trains. of that important section of the company's lines extending from Manchester to Bury, and passing through the favourite residential suburbs of Heaton Park and Prestwich. A map of this district is shown in Fig. 2.

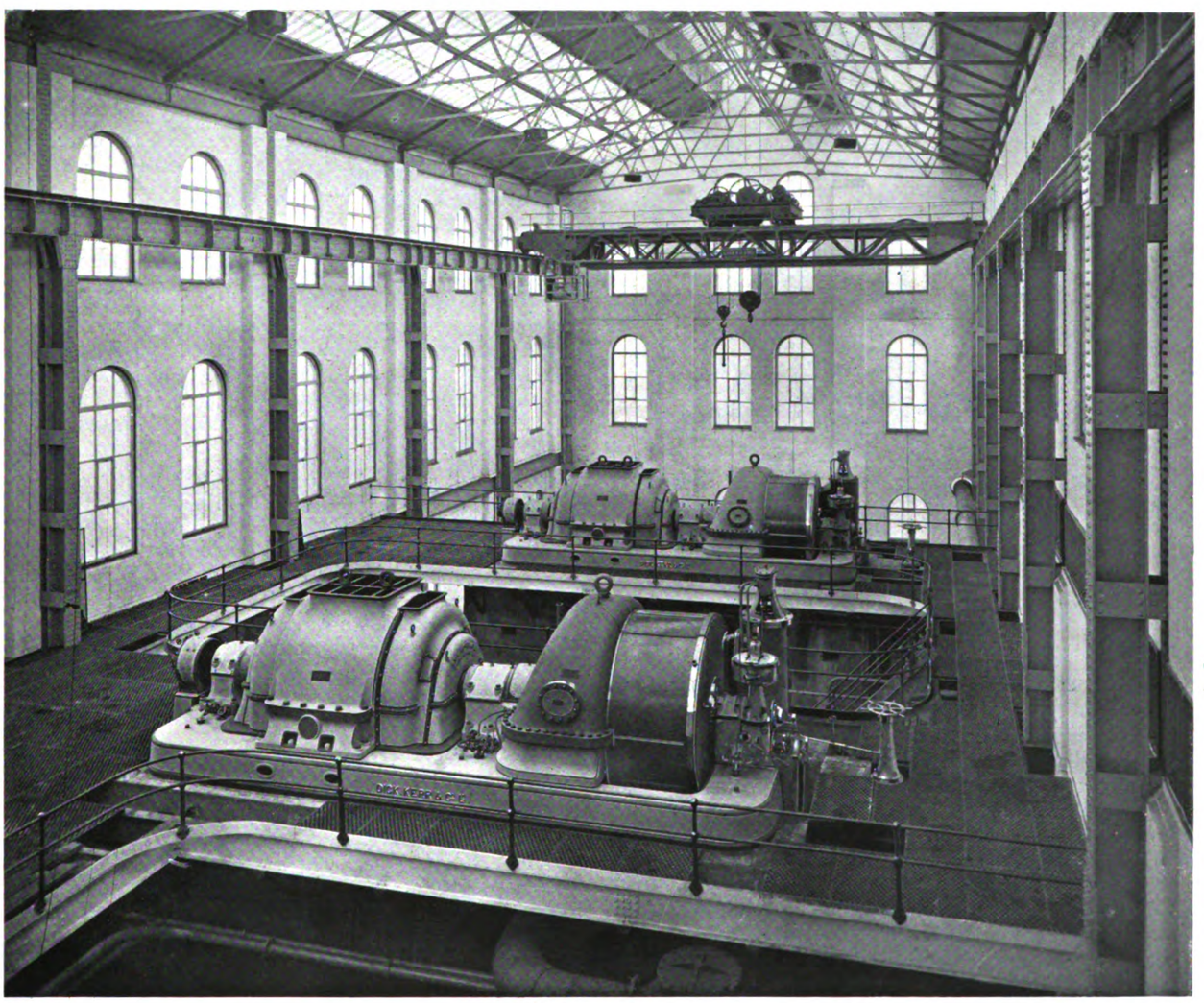

Fig. 1.—View of Engine Room, Clifton Junction Power Station, with 5,000-kw. Dick-Kerr Turbines.

We are now able to publish a fully-illustrated description of the company's latest step in the electrification of their railways. About 18 months ago the directors, acting on the advice of Mr. J. A. F. Aspinall, the general manager, determined upon the electrification

Electrical working was first adopted by the Lancashire and Yorkshire Railway Company on the section between Liverpool and Southport in 1904, and the highly satisfactory results obtained have induced the company to apply electric traction with complete

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confidence on what is familiarly known as the Prestwich Branch. Experience has proved that electrification of suburban railways encourages the growth of traffic, and has the additional advantages of increasing the capacity of the line and of terminal stations.

The Prestwich Branch is the first railway in the Manchester district to be converted to electric traction, and the inauguration of such a service marks an improved stage in the economic development of the city, and the evolution of rapid transit between the city and its suburbs. This district, being the second portion of the Company's system to be electrified, derives the benefit of 11 years' experience gained on the Liverpool and Southport line.

Although the live rail direct-current system, as used on the Liverpool and Southport line, is adhered to, the voltage has been raised from 600 to 1,200. The higher voltage has been adopted in consequence of the satisfactory results gained on the company's electrified line between Bury and Holcombe Brook, where direct current is used at 3,500 volts, but with overhead construction.

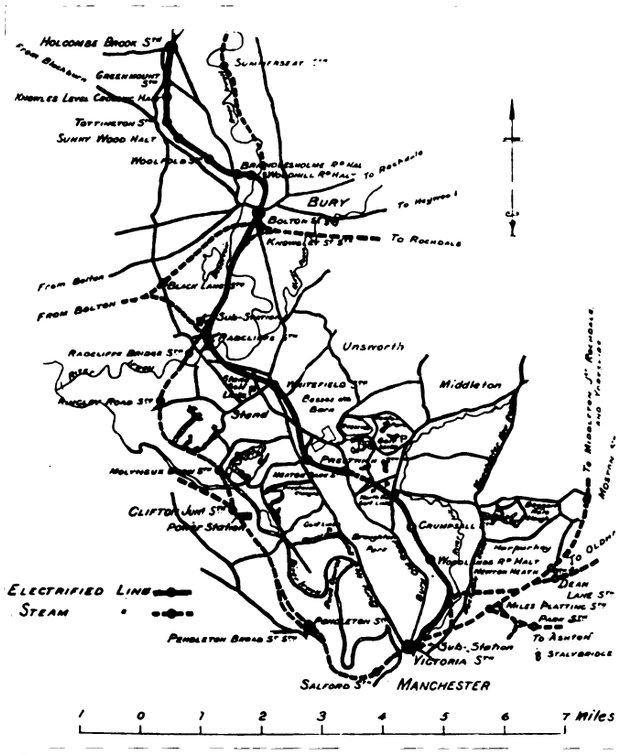

Fig. 2.—Map of Electrified Line, showing Power Station and Sub-Stations.

North Manchester's growing importance as a healthy residential district, and the ever-increasing number of people who are making their homes there, induces the belief that the new undertaking will be as conspicuously successful as its forerunner. This latter line now affords means of rapid transit for thousands of people between their homes on the Southport line and the city of Liverpool. These passengers are given what is claimed to be the fastest suburban service in the world.

Great as have been the improvements in recent years for reaching the inner suburbs of Manchester, the need for improved travelling facilities to the outer suburbs had not been fully met. The time occupied in travelling is often the measure of the distance at which the city worker can live away from his place of business, and this with the usual methods of transit means that he must live within a radius of three miles.

When the full service of electric trains is established on the North Manchester suburban line, the residential area will be increased, because the augmented and accelerated service will bring the outlying districts virtually nearer than they are to-day. Prestwich, for example, is five minutes nearer to Manchester Town Hall than it has been hitherto. The district served by the new electrification scheme, standing as it does at an average height of 300 ft. above the sea level, is becoming increasingly popular for residential purposes. The purchase of Heaton Park by the City Corporation, and the town planning schemes that are in hand, have greatly encouraged building operations in that district.

The electrification was commenced before the outbreak of war. The necessity was felt for a rapid and efficient train service, and as at that time appreciable progress had been made and all tenders placed, the directors decided that the work should be completed at the earliest possible moment.

The scheme has been carried out under the general direction of Mr. J. A. F. Aspinall, the general manager of the railway company, by his chief mechanical engineer, Mr. George Hughes, and his chief civil engineer, Mr. D. C. Rattray. All plans and specifications were prepared and contracts for all plant placed by the chief mechanical engineer's staff at Horwich, in addition to which a preponderance of the detail work, both in connection with the drawings and manufacture of material, has been carried out at the company's locomotive works at Horwich. The civil engineering portion was dealt with by the civil engineering department at Hunt's Bank, Manchester. Although progress has been considerably delayed owing to the present crisis, it is anticipated that the line will be opened for passenger traffic early in the present year.

The length of the line that is now being converted represents 22 miles of single track, but as this is only the first stage of an important electrification project for the Manchester area, it was decided to erect a new power-station of sufficient capacity in the first instance to serve the needs of present requirements and provide for considerable future extensions. In consequence of the war, the full service of electric trains will not be put into force immediately, but 27 per cent. of the existing steam trains will be replaced by electric trains, and further electric trains will be added which will augment the present service by 25 per cent.

When the full electric service is established, there will be ninety trains in each direction per day. The trains will run every twenty minutes between 5.30 a.m. and 7.30 a.m. and 7.10 p.m. and 11.30 p.m., and from 7.30 a.m. to 7.10 p.m. there will be a ten minutes' service to Radcliffe, with every other train running through to Bury, making a twenty minutes' service to the latter town.

The Power-Station.

In the design and situation of the power-station at Clifton, due regard has been paid to the four controlling factors in power-station location, namely:—

(1) It should be as near as possible to the electrical centre of the anticipated supply.
(2) It should have suitable subsoil for foundations.
(3) There should be a good and ample supply of water, and
(4) Easy facilities for the supply of coal and removal of ashes.

Clifton Junction Station, near which the power-station has been built, is a point 4¾ miles from Manchester, on the main line between Manchester and Bolton. Here the generating station occupies a position central to the Lancashire section of the Lancashire and Yorkshire Railway, and is adjacent to extensive coalfields. The foundations are everything that could be desired, and there is a good supply of water from

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the Manchester, Bury and Bolton Canal, which is owned by the railway company.

As the ground level at the power-station is 37 feet below the main line, which at this point is carried on an embankment, coal wagons can be run directly over the tops of the coal bunkers. This arrangement makes use of what is obviously the best coal conveyor, namely, the coal train running between the colliery and the power-station, thus obviating the necessity of installing coal-conveying appliances. For the purpose of handling material between the two levels during the constructional period and for subsequent use, a 50-ton electric overhead travelling crane, manufactured by Messrs. T. Broadbent and Sons, Limited, of Huddersfield, has been provided.

An inspection of the block plan of the power-station and its surroundings (Fig. 3) shows the general layout a substantial design, in which the following objects have been kept in view :—

(*a*) Ample room around the various machinery.
(*b*) Accessibility for repairs and ease of inspection.
(*c*) Abundance of light to all parts, and
(*d*) The layout of the auxiliary machinery specially has been such as to keep everything in full view of the operating staff.

Experience gained with other electrification schemes has shown that power stations generally have not been designed with a sufficient provision for growth, which in the majority of cases has proceeded at a very rapid rate. At Clifton this contingency has been carefully provided for.

Boiler House.—The boiler house (Fig. 9) is 110 ft. long and 90 ft. wide, and is parallel with the turbine room (Fig. 1). The boiler room at present contains three Babcock and Wilcox water tube boilers, each

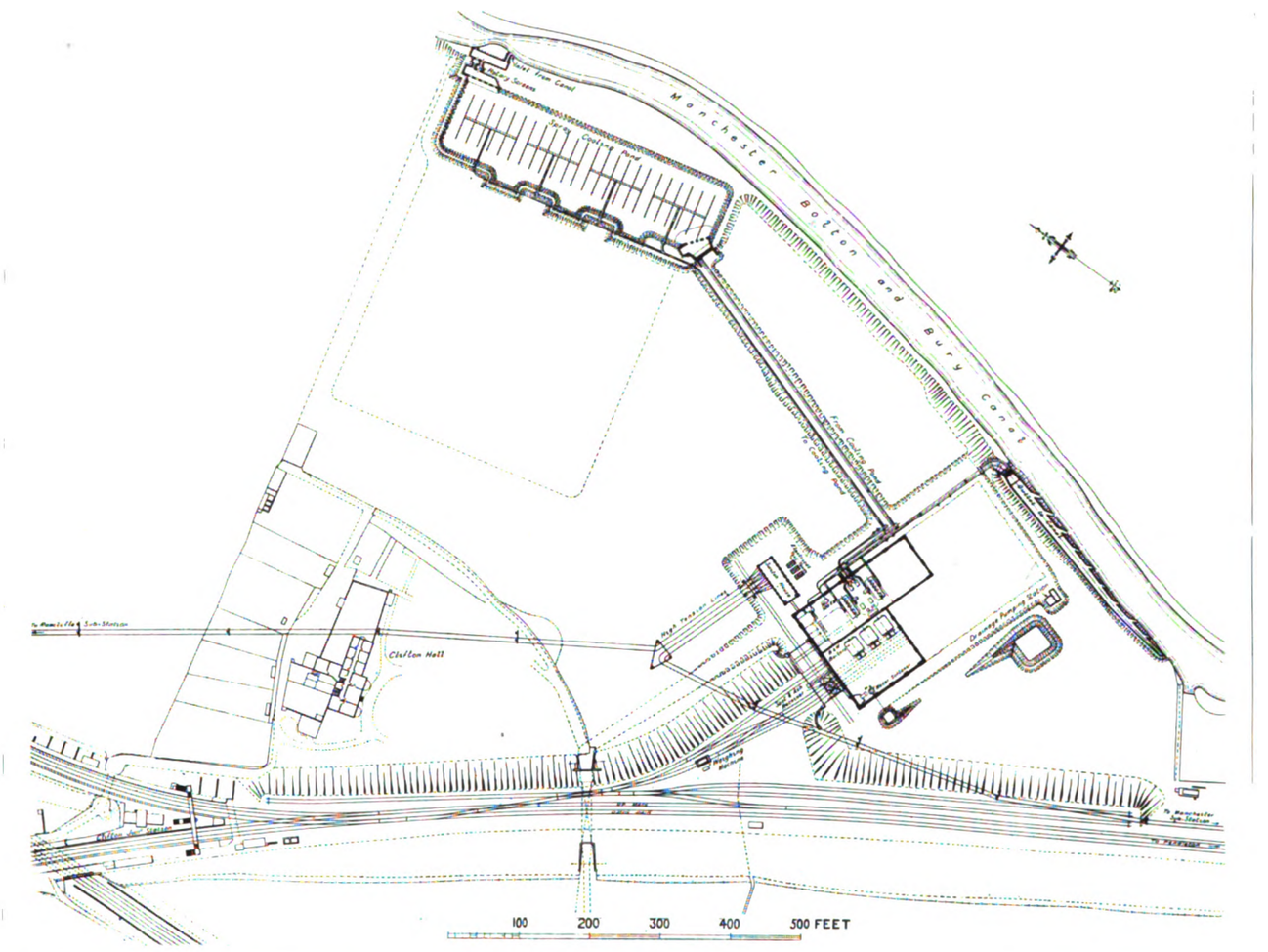

Fig. 3.—Plan of Power Station Site at Clifton Junction.

of the station with regard to the railway and the canal, together with the inlet and outlet connections of the canal for the supply of cooling water. A spray cooling pond is also provided to supplement the natural cooling, which takes place from the canal itself. The slight natural flow of water along the canal is in the direction of Manchester, and the cooling water scheme makes use of this feature, the artificial cooling being brought into play when necessary.

Reference to Figs. 1, 4, 5, 6, 7, and 8 will show that the power-station structure consists of a steel skeleton filled in with brickwork. The steelwork carries the crane runways, roof, economiser floor complete with economisers, fans, and chimneys. The building is of having a normal evaporation of 32,000 lb. of water per hour, from and at 212 deg. Fahr., the steam pressure being 200 lb. per square inch gauge, superheated to 700 deg. Fahr. at the outlet. Fig. 5 shows the boilers arranged in pairs alongside each other ; each pair makes up a steam unit, and is provided with its own induced draught plant and chimney.

Chain grate mechanical stokers, of Babcock and Wilcox's latest type, are fitted to the boilers. The stokers are driven by three-phase, 440-volt motors, and are fitted with a variable speed gear box, allowing a speed variation to the grate of from 6¼ to 25 ft. per hour. The grate area of each boiler is 144 square feet ; the heating surface 7,135 square feet ; and the superheating

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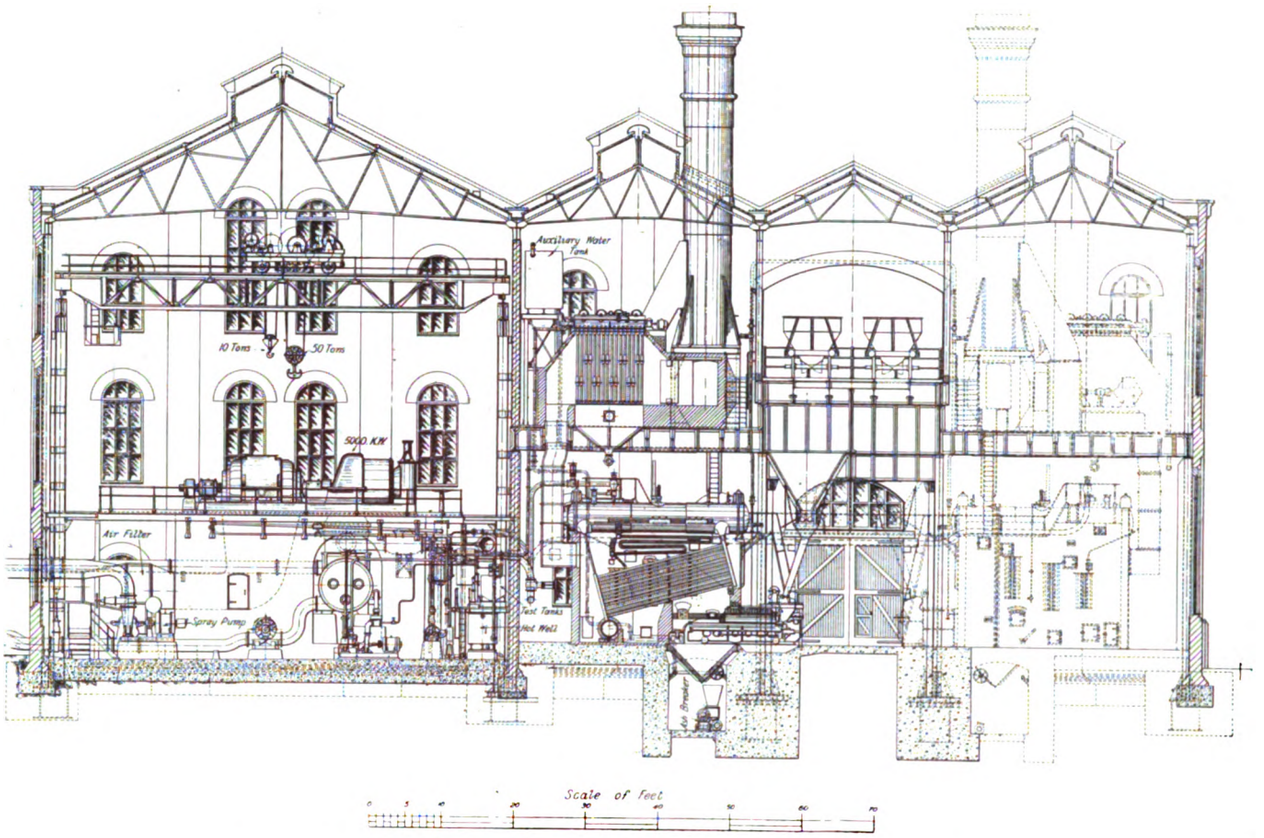

Fig. 4.—Cross Section of Power Station, showing Turbine and Boiler Rooms.

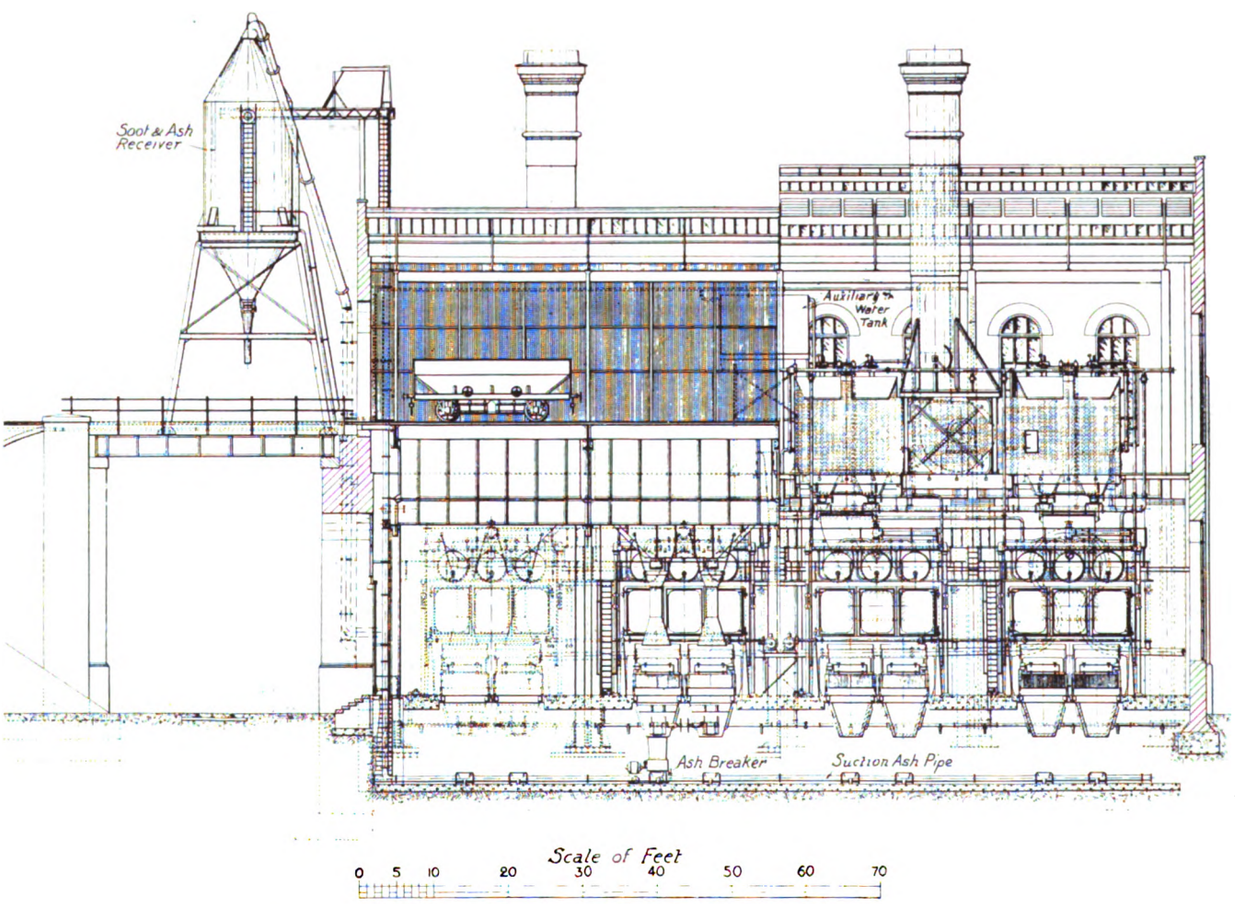

Fig. 5. Longitudinal Section through Boiler and Economiser Rooms.

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surface is 2,635 square feet. Green's economisers are used, and have been placed above the boilers. This position was found to be the most advantageous, as it reduces the width of the boiler room, and the length of the chimney stack, thereby causing a smaller resistance to the products of combustion. Each boiler has its own economiser, which is fitted with 256 tubes, $4\frac{9}{16}$ in. diameter by 9 ft. long. The tubes are provided with three-phase motor, having a speed of 360 revolutions per minute. The motor is of the totally-enclosed squirrel cage type (Fig. 10).

The chimneys, manufactured by Messrs. Clayton, Son and Company, of Leeds, are made up of mild steel plates, varying from $\frac{5}{16}$ in. to $\frac{1}{2}$ in. in thickness. They are 6 ft. internal diameter, brick lined, the tops being 87 ft. 6 in. above the firing floor level.

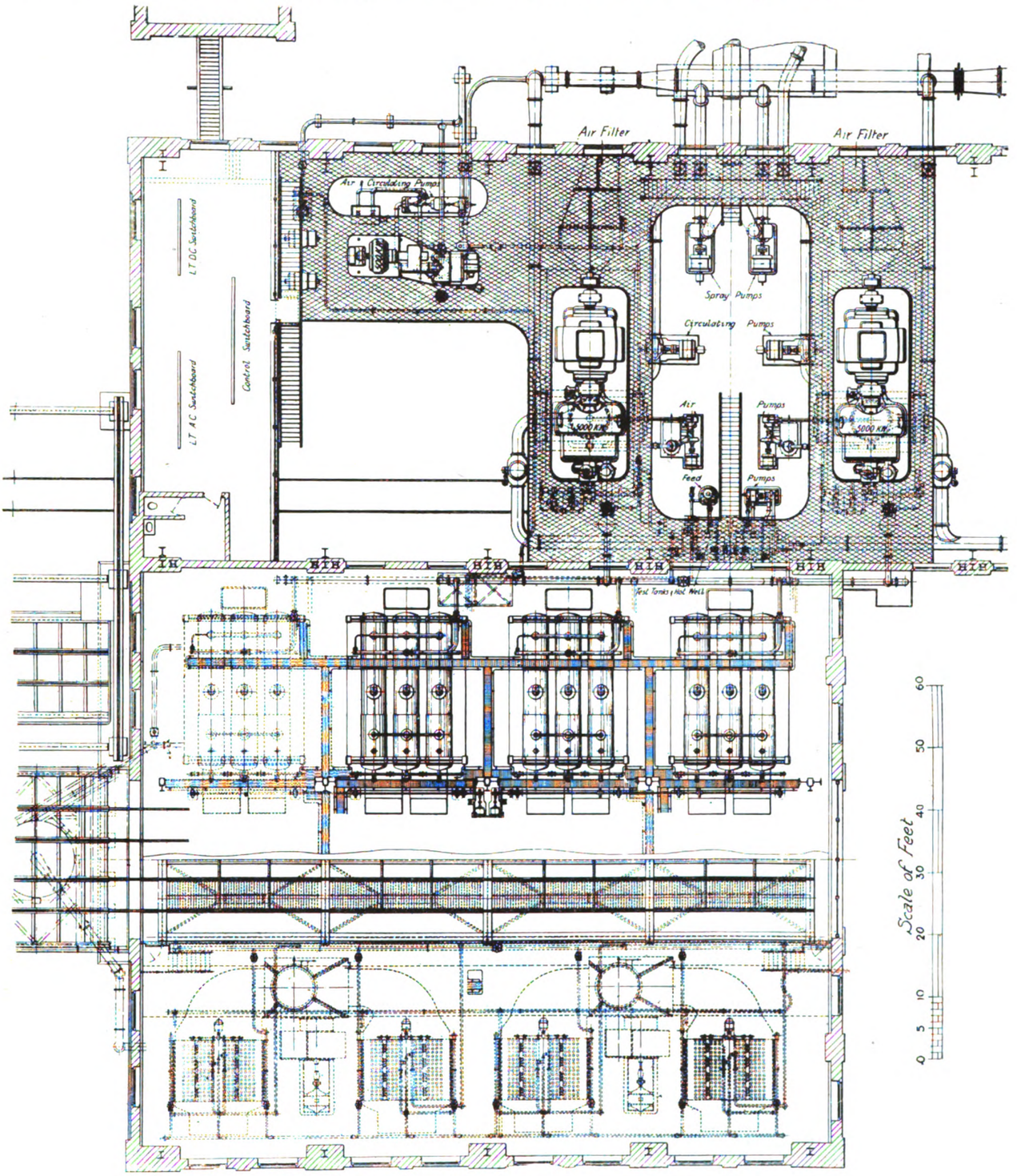

Fig. 6.—Plan of Turbine and Boiler Room.

electrically-driven scrapers. The induced fans are capable of dealing with the products of combustion from two boilers when working together. The fans were manufactured by Messrs. Musgrave and Company, and are provided with ring-lubricated, water-cooled bearings, and are driven by a 40-H.P., 440-volt,

Suction Ash Plant.—The ash from the boilers, after passing over the back end of the grate, drops into ash hoppers, and from that point is taken periodically, by means of Messrs. Babcock and Wilcox's suction ash arrangement, to a large receiver placed at the entrance to the coal bunker roads (Fig. 11). From this receiver

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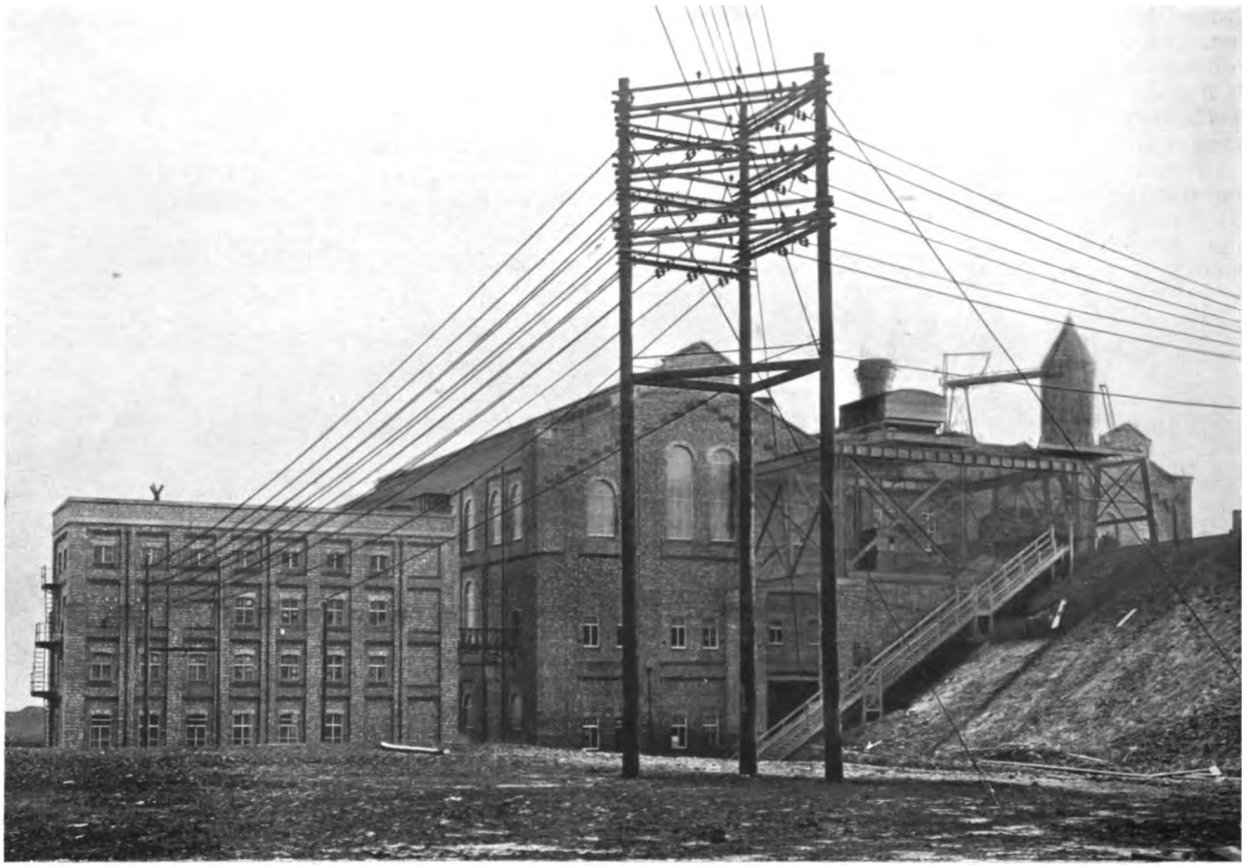

Fig. 7.—North view of Power Station, showing Outgoing Transmission Lines.

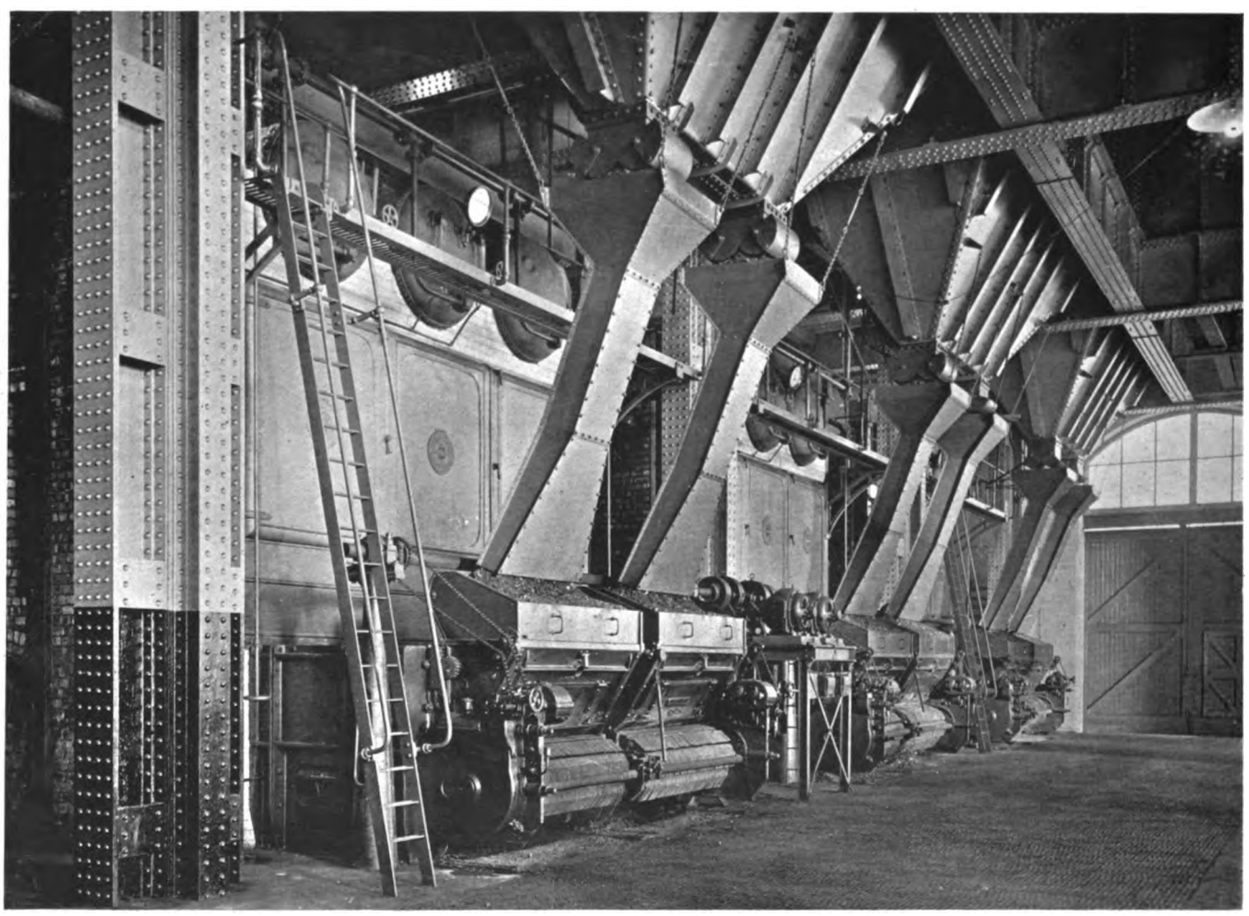

Fig. 9.—Interior of Boiler Room.

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the ash, after having been cooled by a spray of water, injected into the receiver itself, is loaded periodically into wagons at the main line level. Provision is made so that soot from the economisers can be dealt with in the same way as the ash. Electrically-driven ash breakers are provided between the ash hopper and the suction ash pipe. The ash pipe is made of cast iron, and is 8 in. diameter by 1¼ in. thick. It runs along the ash tunnel the full length of the boiler room. In this pipe two inlet boxes are arranged underneath each boiler, so that the ash may drop straight into the ash hopper, through the breaker, direct into these inlet

Fig 8.—Power Station, south aspect.

boxes. At the end of the main ash pipe there is a bell-mouth opening for admitting air. The soot from the economisers is taken by a separate cast-iron pipe running underneath the economiser floor.

The ash receiver has a capacity of 30 tons, and is provided at the bottom with a two-way shoot, so that the contents may be discharged into wagons on either of the roads that run over the coal bunkers. The air exhauster is motor driven (Fig. 12), and is of the Roots' blower type, having a capacity of 3,250 cubic feet of air per minute at a pressure of about 2½ lb. per square in. It was manufactured by the Sturtevant Engineering Company, U.S.A. This type of suction ash plant was fully described in the article on the London and South Western Railway Electrification in our issue of November 18 last.

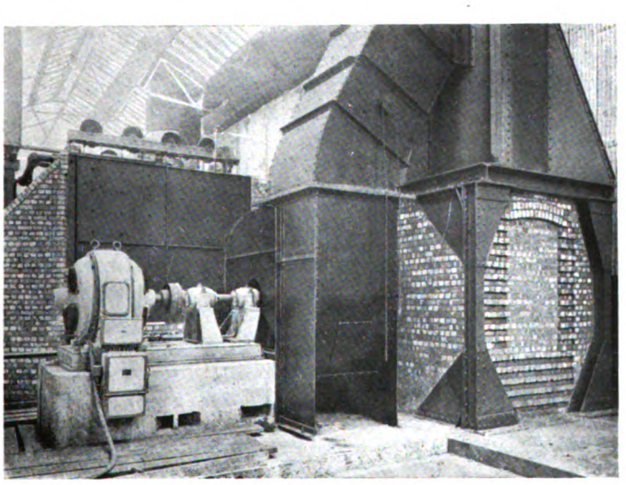

Fig. 10.—Induced Draught Fan and Motor.

Coal Bunkers and Sidings.—The coal bunkers are situated in the centre of the boiler house (Figs. 9 and 11), and are filled by means of bottom hopper wagons, the rail level being 37 ft. above the boiler room firing floor level and 7 ft. above the economiser floor level. The hoppers are constructed of mild steel plating, and are of ample capacity, holding 50 tons of coal without trimming. Corrugated sheet steel partitions separate the coal bunkers from the economisers.

Each boiler is fed by a separate hopper having two

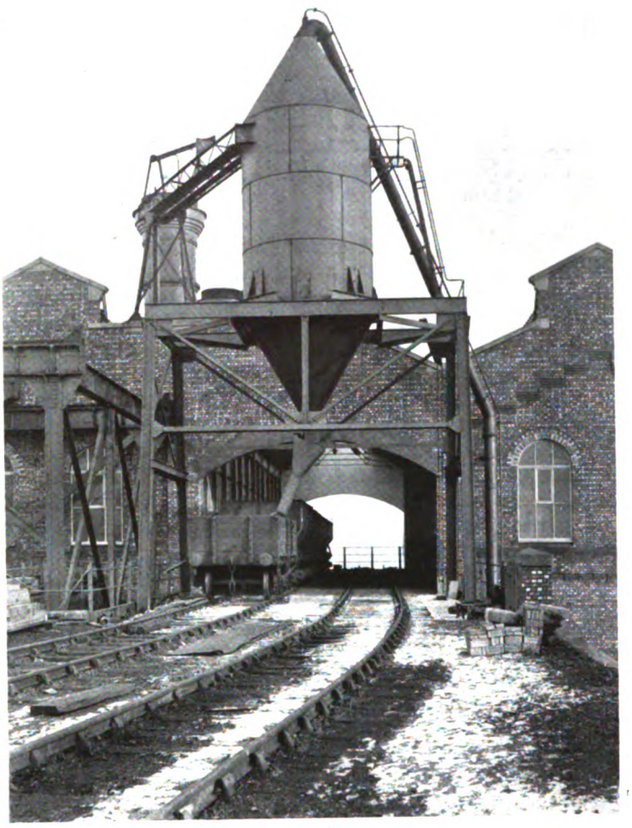

Fig. 11.—Ash Plant Receiver.

shoots directing the coal into the receivers from the chain grate stokers, suitable baffles controlling the supply. A 30-ton weighing machine is provided on the approach road for checking the coal supply. No

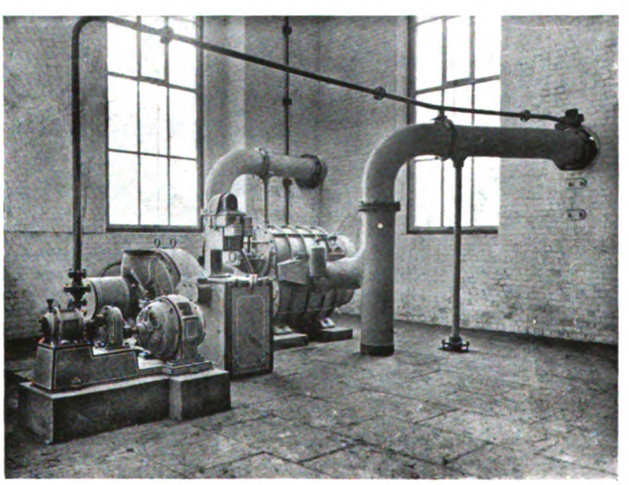

Fig. 12.—Ash Plant Blower.

weighing apparatus has been installed on the bunkers themselves.

There are three coal sidings for the exclusive use of the power-station; two are used for full and empty wagons respectively, having a capacity of twenty-four 20-ton hopper wagons each; and the third siding is

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used chiefly for shunting purposes, and accommodates sixteen 20-ton hopper wagons. Convenient connections are made with the up and down main lines, and the sidings are so arranged that unnecessary shunting is reduced to a minimum, and does not involve the main lines.

Turbine Room.—The turbine room (Fig. 1)—188 ft. long and 64 ft. wide—has a floor of cast-iron non-slip grating. Suitable wells are arranged, so that all auxiliaries in the basement, which is twenty feet below, can be lifted directly by the crane. A 50-ton electric overhead travelling crane, made by Messrs. T. Broadbent and Sons, Huddersfield, is provided in the turbine room. It has a span of 61 ft., and travels the full length of the building.

5,000 *kw. Turbo Alternator Sets.*—Two main generator sets, each having a normal capacity of 5,000 KW., are installed. The turbines are manufactured by Messrs. Dick, Kerr and Company, Limited, Preston. They are of the impulse type, having a Curtiss wheel at the high pressure end, the remainder being on the Rateau principle. The speed is 1,500 revolutions per minute. Each turbine has two rows of wolfram steel blades on the velocity wheel, and ten rows of brass blades on the low pressure wheel, the axial and radial clearances being 5 mm. and 7 mm. respectively. The governor gear of each turbine is fitted with a small electric motor, enabling the gear to be controlled from the main switchboard. The total weight of each turbo-alternator is 115 tons 16 cwts. Each alternator consists of a Dick-Kerr two-pole three-phase machine generating at 6,600 volts, 25 cycles, and is capable of carrying 25 per cent. overload for two hours and 50 per cent. overload for five minutes. The alternators are self-ventilated by means of fans fitted on the shaft at each end of the rotor. The air for ventilation passes through Heenan and Froude wet air filters, each of which can deal with 25,000 to 30,000 cubic feet of air per minute, the air passing through the filter at an approximate velocity of 1,500 ft. per minute.

Each turbo-alternator is complete with its own condensing plant, the latter being manufactured by

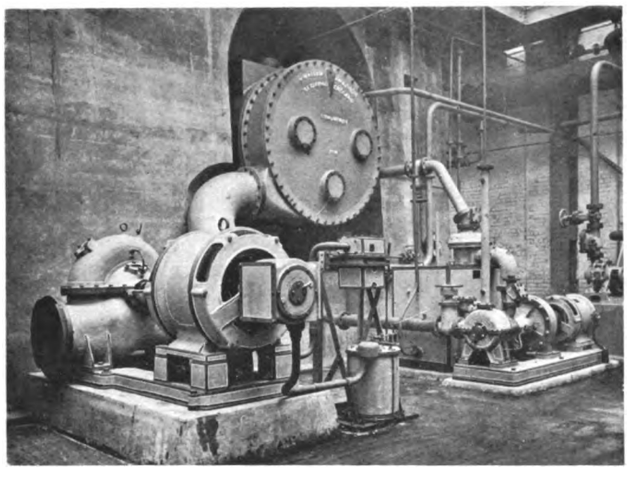

Fig. 13.—Condensing Plant, 5,000 kw. set.

Messrs. W. H. Allen, Son and Company, of Bedford, and consists of condenser, steam jet ejector, circulating water pump, kinetic air pump, extraction and delivery pumps (Fig. 13).

The condensers are of the surface type, of sufficient capacity to deal with 82,000 pounds of steam per hour, and are capable of maintaining a vacuum of 28·1 inches (barometer 30) at full load when supplied with cooling water at the rate of 6,700 gallons per minute at a temperature of 75 degrees Fahr. The condensers have a diameter of 80 inches, and each is fitted with 3,464 tubes having an internal diameter of $\frac{3}{4}$ in., the total cooling surface being 9,500 square feet. The weight of each condenser (exclusive of water) is 38 tons.

The circulating water pumps are of the "Conqueror" centrifugal self-regulating type, with 20 in. diameter suction and delivery branches, and are capable of delivering 6,700 gallons of water per minute, against a 35 ft. head when running at 485 revolutions per

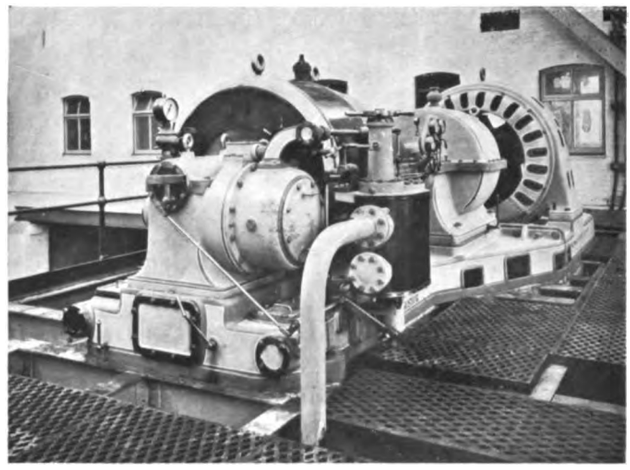

Fig. 14.—View of 500 kw. set.

minute. Each pump is directly driven by a Dick-Kerr slip ring induction motor, of 110 B.H.P. The steam jet ejector is supplied by a $1\frac{1}{4}$ in. steam pipe, and the estimated steam consumption is 0·75 per cent. of the turbine steam consumption. When on full load, this will take 465 lb. of steam per hour.

The kinetic air pump (7 in. bore, 45,000 gallons per hour, 90 ft. head), extraction pump (5 in. suction, 3 in. delivery, 10,200 gallons per hour, 40 ft. delivery head), and the delivery pump (3 in. suction and delivery 10,200 gallons per hour, 20 ft. head) are all mounted on one bed-plate, and driven by means of a Dick-Kerr 45 B.H.P. slip ring motor at 1,450 revolutions per minute.

500 *kw. Geared Turbo-Alternator.*—Power for the auxiliary apparatus is provided by a 500 KW. gear driven turbo-alternator, built by the British Westinghouse Company, of Manchester (Fig. 14). This set, which is complete with a surface condensing plant, generates power at 440 volts, 25 cycles, and the turbine is of the Westinghouse high pressure impulse type, running at 3,600 revolutions per minute. The turbine has two rows of nickel steel blades on the velocity wheel, and ten rows of nickel steel blades on the low pressure wheel, the axial and radial clearances being $\frac{1}{8}$ in., $\frac{3}{16}$ in., and $\frac{1}{4}$ in. respectively. The total weight of the turbo-alternator complete with gear and gear-case is approximately 30 tons.

The gearing, which gives a speed reduction 3,600–750 revolutions per minute, has been manufactured by Messrs. David Brown and Sons, Limited, of Huddersfield. The gear wheel has a rim of special high carbon steel built up on a steel spider, and has 183 teeth. The pinion is made from solid nickel steel and has 38 teeth, with a pitch of teeth 0·597 in. and a face width of 21 in.

The generator is of the Westinghouse alternating-current engine type, capable of giving a continuous output of 500 KW.

The condensing plant is on the Westinghouse-Leblanc patent system, and consists of condenser,

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circulating water pump, air pump, and extraction and delivery pump. A Westinghouse surface four-flow type condenser is used, which has a cooling surface of 850 square ft. It is capable of dealing with the turbine exhaust and maintaining a vacuum of 27·5 in.–28·5 in.

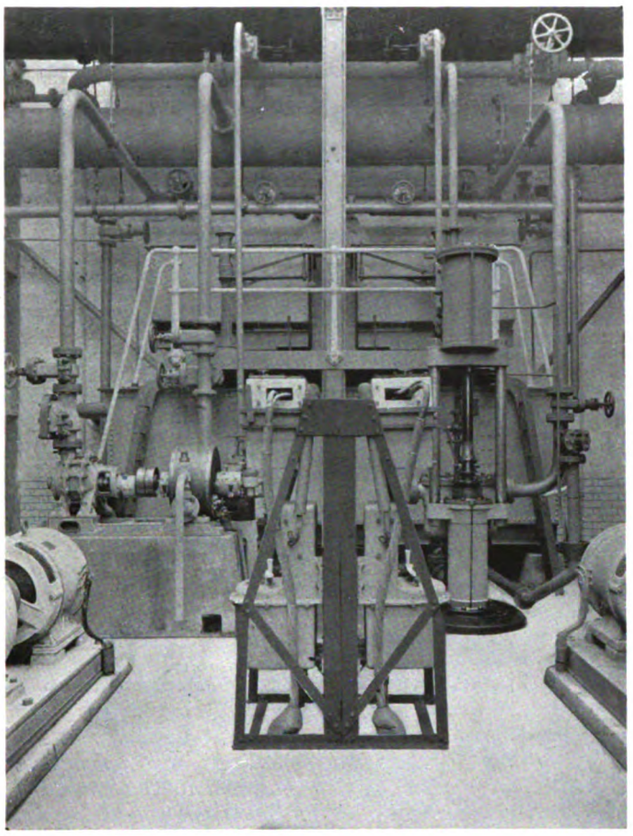

Fig. 15.—Boiler Feed Pumps, Test Tanks and Hot Well.

(barometer 30 in.) on full load, when supplied with cooling water at the rate of 784 gallons per minute at a temperature of 75 deg. Fahr. It is 6 ft. 8½ in. between tube plates, and contains 652 tubes of solid drawn brass ¾ in. O.D. and 18 I.W.G. The total weight is approximately 5 tons.

The circulating water pump is of the centrifugal type, having 8 in. suction and delivery branches, and is capable of delivering 784 gallons of water per minute against a head of 23 ft. when running at 1,440 revolutions per minute.

The air pump is of the Westinghouse-Leblanc rotary valveless dry air type, with a 4 in. suction branch and a 3 in. delivery branch. A centrifugal extraction and delivery pump is used, capable of delivering 11·6 gallons of water per minute against a head of 8 ft., when running at 1,440 revolutions per minute. All the three pumps are mounted on one common bed plate, and driven by a 22-B.H.P. motor, and the approximate weight of the combined set is two tons.

The hotwell (Fig. 15) is arranged centrally between the main generators, and is of liberal capacity, holding 1,460 gallons. It is divided into two compartments, so that the valves may be examined, and the tanks cleaned and painted, without putting it out of commission. Provision is made for a supply of make-up water from an auxiliary tank, fed from the circulating water mains. This water is treated in a softener, and the supply regulated by a 3 in. float valve in the hotwell. An emergency connection is also taken from the town main; this also is controlled by a similar valve operating at a lower level in the hotwell.

The condensate from the turbines is introduced at a point below the minimum water level in the hotwell, so as to prevent aeration. Connections are taken from the underside of the hotwell, one from each division, uniting in a common main to the feed pump suction. The water in the hotwell is heated by means of four 3 in. exhaust steam injectors, the exhaust steam being taken from the turbine feed pump. Two test tanks, mounted on weighing machines, are carried on the top of the hotwell, and arranged to work alternately and independently of each other. The condensates from all the sets are so conveyed to the hotwell that the condensate from any one set can be passed through the test tanks, while the others are delivered directly to the hotwell.

A suitable tumbler, constructed to direct the flow of water into one tank or the other, is placed between and above the two tanks. By this means, the water is diverted without interfering with the continuous delivery from the set under test. Each test tank has a total capacity of 3,800 lb. of water, discharging through a 6 in. quick-acting valve directly into the hotwell below.

The weighing machines are graduated to read zero when the tanks are empty.

Boiler Feed Pumps.—At present the station is equipped with two boiler feed pumps, supplied by Mather and Platt, Limited, of Manchester; one a turbine pump, and the other a reciprocating pump, both capable of delivering 10,000 gallons of feed water per hour against a head of 217 lb. per square in. It is interesting to note that the reciprocating pump is the only reciprocating machine in the station. It is intended that the turbine pump should be used in service, and the reciprocator as a standby. Both pumps are situated near the hotwell, and at such a level that they are always flooded (Fig. 15).

The turbine pump is of the high lift, multiple chamber type, absorbing 40 B.H.P. It has a 5 in. suction, and a 4 in. delivery, and is driven by a 45-B.H.P. high-pressure turbine of the horizontal Curtiss type, made by the British Thomson-Houston Company, of Rugby, and runs at 3,000 revolutions per minute. The weight of the combined set is approximately one ton.

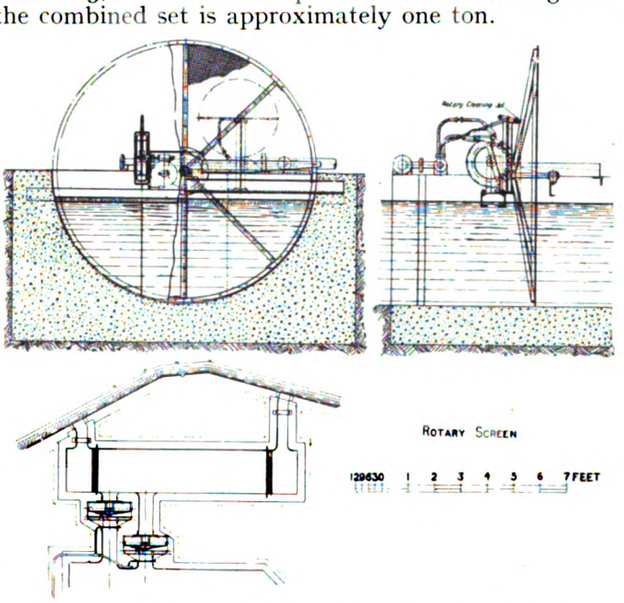

Fig. 16.—Plan and Elevations of Rotary Screen.

The reciprocating pump is double acting, and makes 13 double strokes per minute. Its chief dimensions are, cylinder 10 in. diameter, 24 in. stroke, suction branch 6 in. diameter, and delivery branch 4 in. diameter.

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Spray Pumps.—Two spray pumps are installed for the purpose of dealing with the cooling of the circulating water. These pumps, with their motors, are exactly similar to the circulating water pumps for the main sets.

Condensing water is obtained from the canal, and it passes first through a bar screen, which stops the entrance of the larger pieces of floating matter, and then through rotary screens, which check the smaller weeds, etc., before reaching the cooling pond. The rotary screens (shown in Figs. 16 and 17) are two in number, each 10 ft. in diameter, and rotate at one revolution per minute. They are driven by Pelton wheels through worm gearing; the water for driving them is obtained from the spray pump discharge, and is under a head of 18 ft. When the spray pumps are not working the water is obtained from the auxiliary tank. The screens are cleaned by means of rotating jets, which spray on the exposed portion of the screens, on the side away from the incoming supply of cooling water. A diagram of the circulating water-pipes is shown in Fig. 18.

Fig. 17.—Rotary Screens.

The water flows from the cooling pond into a brick-lined collecting pit, and thence by gravity down a 45 in. pipe into the circulating water suction main. This suction main has a maximum diameter of 62 in., and is of sufficient area to supply the demand of the whole station when extensions are completed. The present pipe supplies the two main condensers, the auxiliary condenser, also the water to the auxiliary tank, and is capable of easy extension as required. Water having passed through the condensers, flows by gravity into a 62 in. diameter discharge main running parallel with the suction main. This pipe is fitted with suitable branches for future extensions, and discharges into a concrete channel running parallel with the canal, having outlets at convenient points. This channel is shown in Fig. 19.

Fig. 19.—Condensing Water Outlet to Canal.

Connections are taken from the discharge main to the spray pumps, so that the hot circulating water can be pumped back to the cooling pond through the spray nozzles. Thus, two methods of cooling are available, or a combination of both methods can be used at the same time. The discharge pipe from the spray pumps to the cooling pond is 32 in. diameter, and runs alongside the 45 in. diameter delivery pipe from the pond.

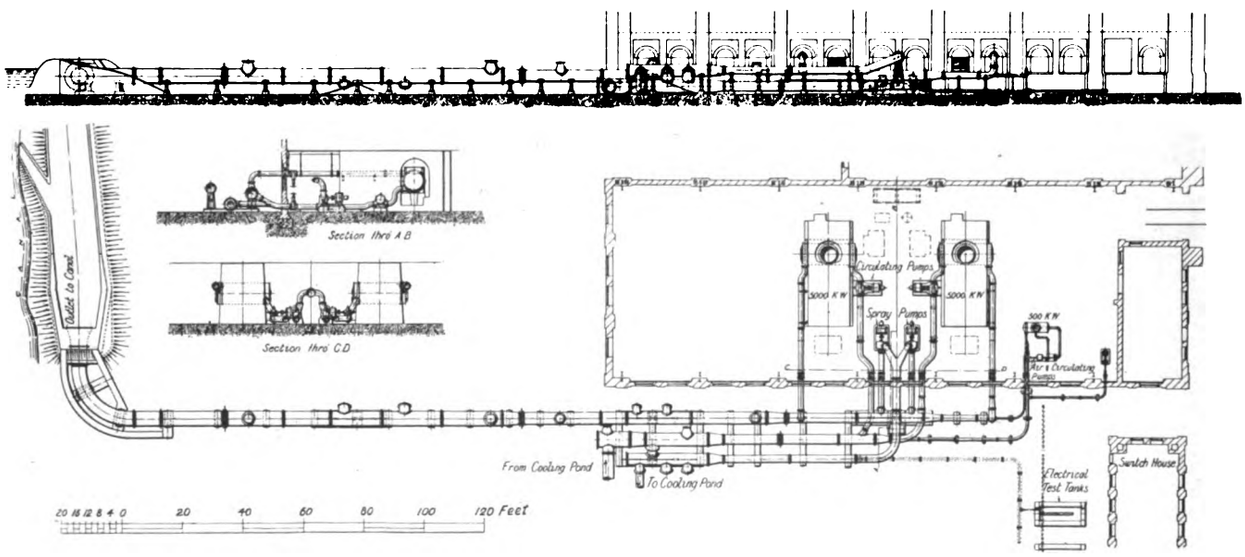

Fig. 18.—Arrangement of Circulating Water Pipes.

Cooling Pond.—This is 408 ft. long, 109 ft. wide, and 2 ft. 6 in. deep. The spraying arrangement has been supplied by Harrison, Son and Jobson, Limited, Middlesbrough, and is capable of cooling 402,000 gallons of water per hour from 95 deg. Fahr. to 75 deg. Fahr. under normal atmospheric conditions; it is so arranged that slight extension to the pipe work will increase the capacity to 804,000 gallons per hour. The

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piping is constructed in four separate units, each unit being controlled by a valve situated in a convenient position on the pond side.

Each unit is divided into three lengths of parallel piping, 32 ft. apart. Screwed in each pipe are 24 brass nozzles spaced 3 ft. apart, thus making a total of 288 nozzles for the present plant. Each nozzle orifice has an area of 0·39 square inch, and is capable of passing 1,396 gallons of water per hour at a head of 18 ft. The circulating water-pipes have been manufactured by Messrs. Clayton, Son and Company, of Leeds, and at the railway company's works at Horwich.

Auxiliary Water Supply.—An auxiliary water supply has been installed to meet the demand for water other than that required from the town main. This water is delivered into a storage tank from the circulating water suction main by means of a Mather and Platt turbine pump situated in the turbine room basement. This pump has a capacity of 12,000 gallons per hour, against a head of 50 ft., when running at a speed of 1,420 revolutions per minute. It has a 5 in. diameter suction, and a 4 in. diameter delivery, and is driven by a 6 H.P. induction motor. The pump and motor are mounted on one common bed-plate. The auxiliary tank is situated above the economiser floor, and has a capacity of 2,900 gallons.

The delivery water from the pump is controlled by a 5 in. float valve in the tank. An emergency connection is taken from the town main, and is controlled by a 3 in. float valve operating at a lower level than the 5 in. valve. The auxiliary tank supplies water to the hotwell for make-up, to the main condensers for flooding purposes, to the oil coolers, bearings, and smaller details in the turbine and boiler rooms.

Water Softener.—The water softener, manufactured by Bowes, Scott and Western, Limited, London, has a capacity of 1,000 to 1,500 gallons of water per hour. It is 20 ft. 6 in. high, with a diameter of 6 ft. 3 in.; the decanter has a settling tank capacity of 3,940 gallons.

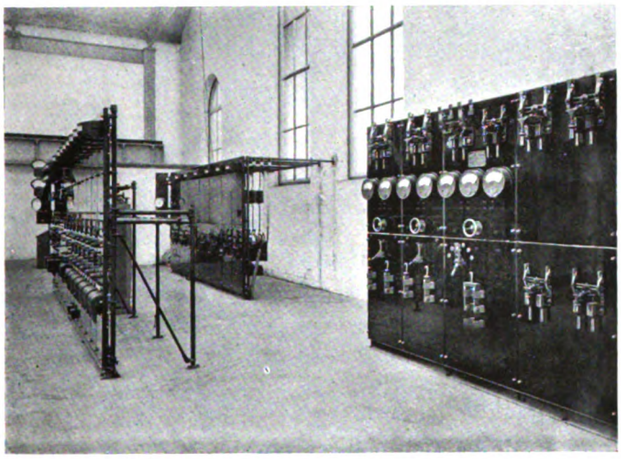

Fig. 20.—Switchboards on Control Platform.

Control Boards and Switchgear.

At the end of the station are arranged stores, offices, and switchboard platform. The stores are alongside the main entrance on the basement floor, and immediately above them on the turbine room floor are arranged the offices for the operating staff. The control switchboards are placed on a gallery above the offices, overlooking the turbine room, and the control wiring is accommodated in the cable room between the ceiling of the offices and the switchboard gallery.

The arrangement of the switchboards on the control platform is shown in Fig. 20.

There are three separate boards :—

(1) The main control board for operating the main units and feeders.
(2) 440-volt A.C. board operating the station auxiliaries.
(3) D.C. board controlling the control circuits, lighting, cranes, and standby battery for the control circuits.

Switchgear.—The switchgear, manufactured by the British Thomson Houston Company, is of the solenoid operated remote control type. The main switchgear is housed in a separate building (see Fig. 6), access to which is obtained by a footbridge from the turbine room floor. The switchhouse consists of a four-storey building, on the ground floor of which is housed the battery consisting of 70 cells. The first floor is the cable room, the second floor the switch room, and the third floor the bus-bar room. A plan of the switchhouse is shown in Fig. 21 and a cross section in Fig. 22.

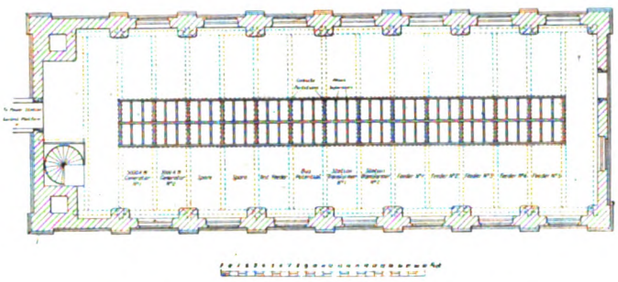

Fig 21.—Sectional Plan of Switchhouse.

The control board of the gallery consists of 13 panels, on which are mounted the necessary equipment for controlling the main switchgear for the two 5,000-KW. generator equipments, with two blank panels for future extensions; five 300-KW. feeder equipments, two 250-KW. transformer equipments, one test feeder equipment, and one synchronising equipment. The 400-volt, three-phase switchboard consists of five panels, on which are mounted hand-operated oil switches and the necessary gear for controlling two 250-KW. transformer equipments, one 500-KW. generator, two rotary converter equipments, and two feeder panels. The D.C. board consists of five panels, two controlling the D.C. side of the rotary converters, one the 125-volts battery, and two feeder panels, for the main control, lighting, and crane motors.

The main switchgear in the switchhouse is contained in cells built up of moulded stone (Figs. 23 and 24), each phase being separated throughout with barriers of the same material. The bus-bars with the bus-bar isolating switches are placed on the floor above the switch room, the cell construction being of a similar character to the above. The fronts of the cells are covered by expanded metal sliding screens, these screens being interlocked with isolating switches, so that it is impossible to open out any cell until the isolating switches controlling the apparatus in that cell have been opened. The cells containing the oil switches, which are shown in Fig. 24, have metal doors which are not interlocked.

The main cables are suspended from the footbridge which gives access to the switch room, and enter the cable room immediately beneath the switch room, being taken up to their respective cells as required. The outgoing feeders are carried from their respective cells, and supported by insulators from the ceiling, passing through the wall of the switch house by means of leading-in tubes, to the overhead lines outside (Fig. 7).

The bus-bars are in duplicate, and so arranged that any machine, or any set of feeders, can be connected to

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either set of bus-bars, but no machine, or no particular set of feeders, can be connected to both sets of bars at the same time, the isolating switches for the bus-bars being interlocked to prevent this. By this means, one set of bus-bars can be used for power purposes, whilst

required between the control board and the switch gear. An indication of the position of the switch is given by red and green lamps, which are placed vertically above and below the pull type switch. The controlling switch for the lamps is operated by the movement

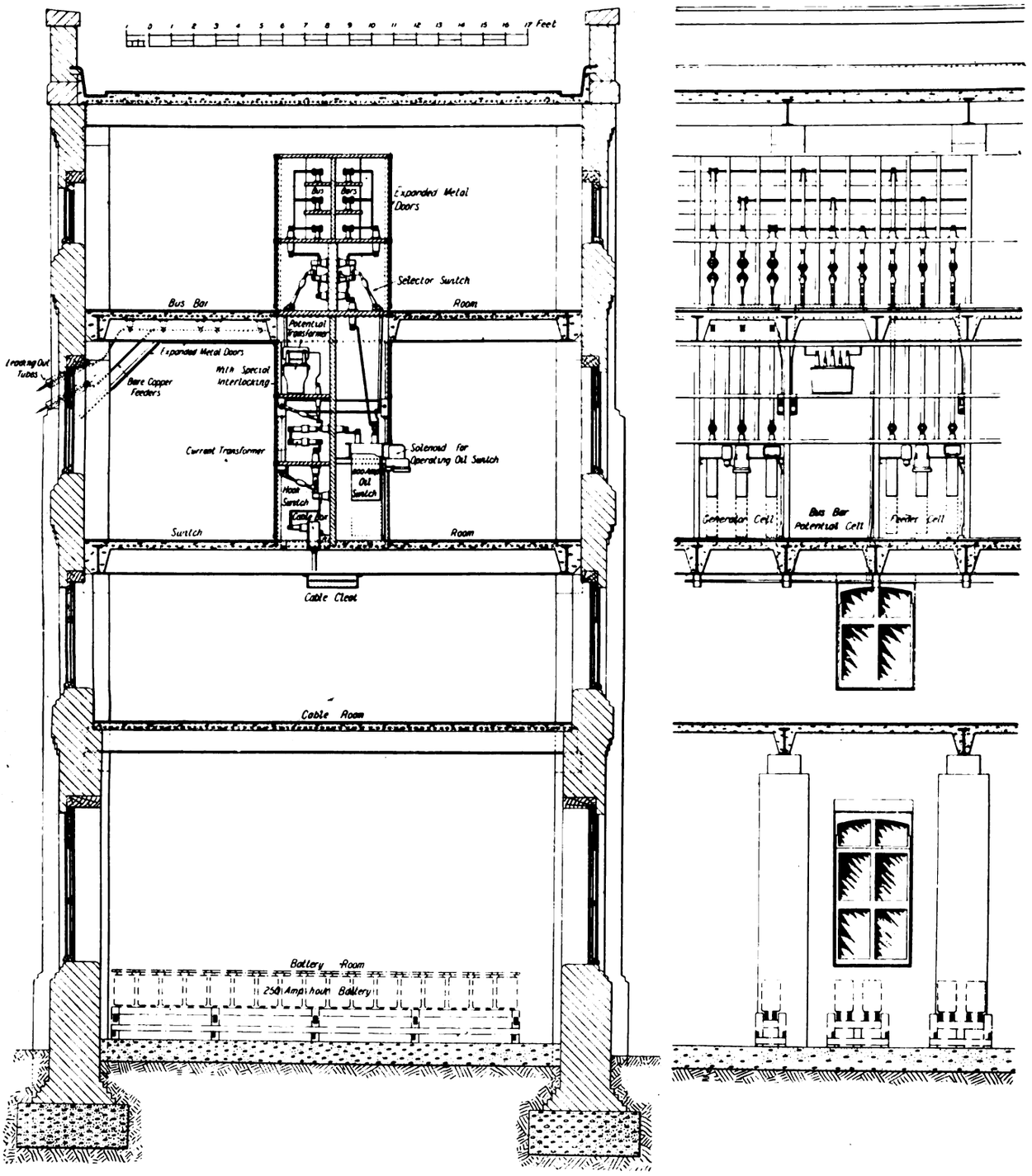

Fig. 22.—Cross Section and Part Elevation of Switchhouse.

the other at the same time can be utilised for general test purposes. The order of the cells is exactly the same as that of the control switchboard.

The main oil switches are operated by means of pull type switches on the control board, which energise relay switches mounted on the oil switch. Relays are used in order to restrict the size of the cable of the oil switch itself. The voltage of the control current is 125.

A throw-over switch is provided on the synchronising panel, by means of which an emergency excitation can be brought into operation should the exciters fail. This excitation current is regulated by means of a rheostat, which is mounted immediately behind this panel.

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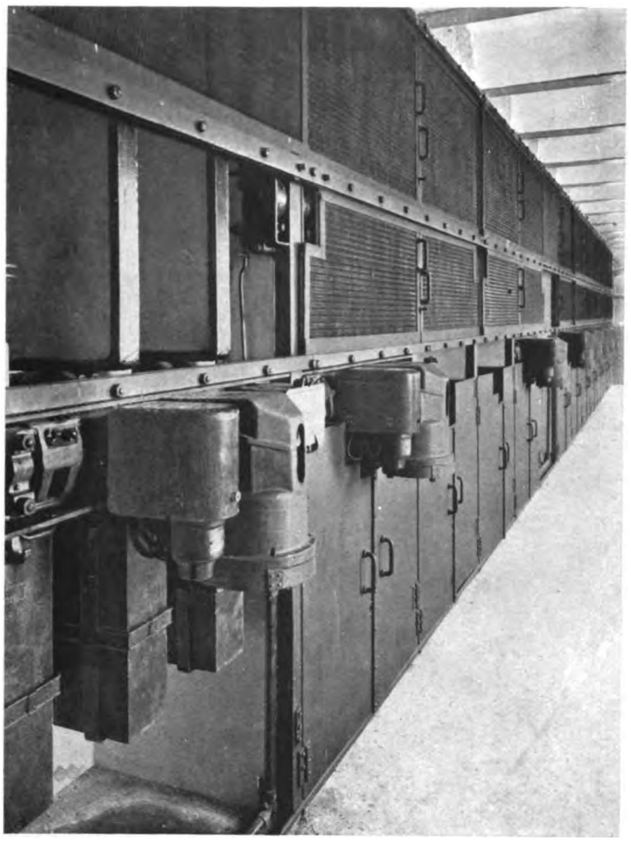

Fig. 23.—Oblique view of Oil Switches on second floor of Switch-house.

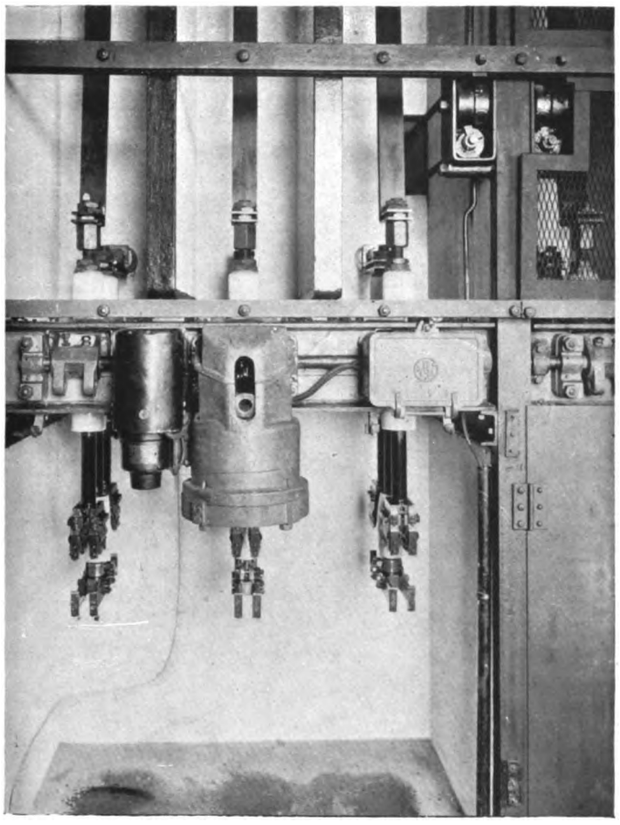

Fig. 24.—Front view of Oil Switches, the Oil Containers being removed.

With the switchgear a system of balance protective gear has been provided for the turbo-alternators and the station transformers. This is operated by means of current transformers and relays. Should a fault occur between phases, or between any phase and earth these relays operate, and trip the main oil switch.

In addition, automatic field switches are provided for the turbo-alternators. These open the field circuit automatically when an internal fault occurs in the turbo-alternator, which at the same time operates the protective gear and trips the main oil switch.

In normal running the station auxiliaries will be worked through two station transformers of 250 KW. each, manufactured by the British Transformer Co., of Heyes, converting from 6,600 to 440 volts, three-phase, and enabling the 500 KW. auxiliary set to be shut down. During periods of very light load, such as lighting of stations during the night time, the auxiliary set can be run alone, and the voltage raised through the same transformers to 6,600 for transmission to the various stations or goods yards.

The D.C. at 125 volts is obtained by means of two rotary converters operating through transformers from the 440 volt supply. Each of these converters has a capacity of 50 KW., and they were made by the British Westinghouse Company. They are used in conjunction with a 70-cell battery (made by the Chloride Electrical Storage Company, of Clifton Junction) and a small booster.

Fig. 25.—High Tension Transmission Lines, carried on H poles.

All drainage from the station is treated by a drainage plant situated at some distance from the building. After treatment, the drainage is dealt with by means of a vertical spindle "Sunturbo" pump, manufactured by Peter Pilkington, Limited, of Bamber Bridge, near Preston. This pump is capable of dealing with 80,000 gallons of water per hour, against a total head of 32 ft., when running at a speed of 715 revolutions per minute, and is driven through vertical shafting by a 4-pole, 20-H.P. three-phase motor. The weight of the combined set is 1¼ tons approximately.

High Tension Transmission Line.

Two main feeder lines are used to convey the power from Clifton Junction power-station :—

(1) The north line, 4 miles long, runs from the Clifton power-station to Radcliffe sub-station, *via* Ringley Road.
(2) The south line, 4¼ miles long, runs from Clifton power-station to Manchester, Victoria sub-station, *via* Pendleton New.

Both these feeders are of the same capacity, and consist of overhead conductors, of three cables in duplicate, and three-core cables, paper insulated, lead covered, and armoured with steel galvanised wires

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in duplicate. The overhead cable, supplied by the British Insulated and Helsby Cables, Limited, Prescot, and Thomas Bolton and Sons, Limited, consists of 7/10 S.W.G. per phase; the three-core of 19/14 S.W.G.

The south line consists of 1¼ miles of overhead and 3½ miles of cable. The overhead is carried throughout on "H" poles (Fig. 25), the conductors being arranged three on each side of one pole, the other being left for future extensions. The standard span used is 70 yards. The three-core cable is carried on posts, and, where convenient, on wall brackets. Both lines are in duplicate, and under ordinary working conditions will both be in use.

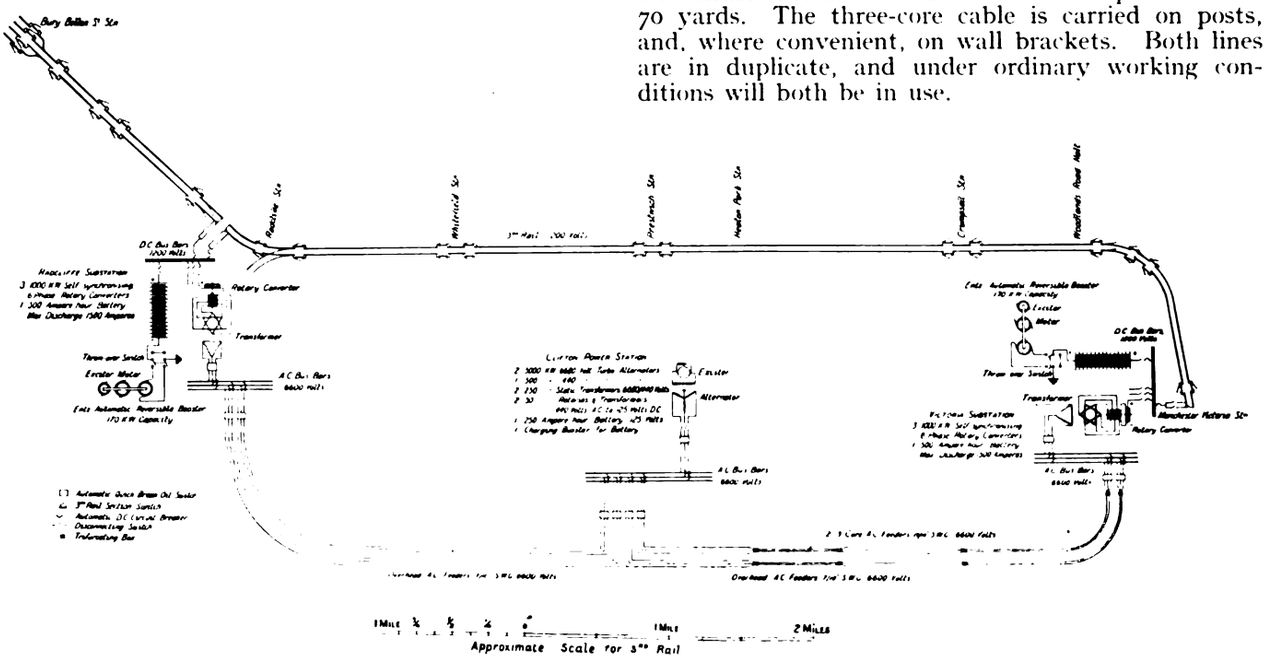

Fig. 26.—Diagram of Electrical Connections from Power Station to Sub-Stations and Track.

per phase was manufactured by W. T. Henley's Telegraph Works Company, Limited, London.

The outer diameter of the three-core cable is 2·293 in., the armouring 0·1 in., and the thickness of the lead 0·14 in. The joints are of the plumbed lead sleeve type, and the conductors are insulated with paper sleeves, the boxes being filled in with compound. The north line is practically all overhead, cable only being used when passing under public bridges.

The "H" poles consist of two fir poles of an average diameter of 10 in., six feet from the butt. The cross arms supporting the insulators are of channel iron, 4 in. by 2 in. by ½ in., clipped on to the pole. The pole is also braced with wooden struts and bolts, but no anchor stays are used except at points where the line makes an angle. The whole of the armouring, and also the ironwork on the poles, is earthed to copper earthing plates, at quarter-mile intervals. No lightning

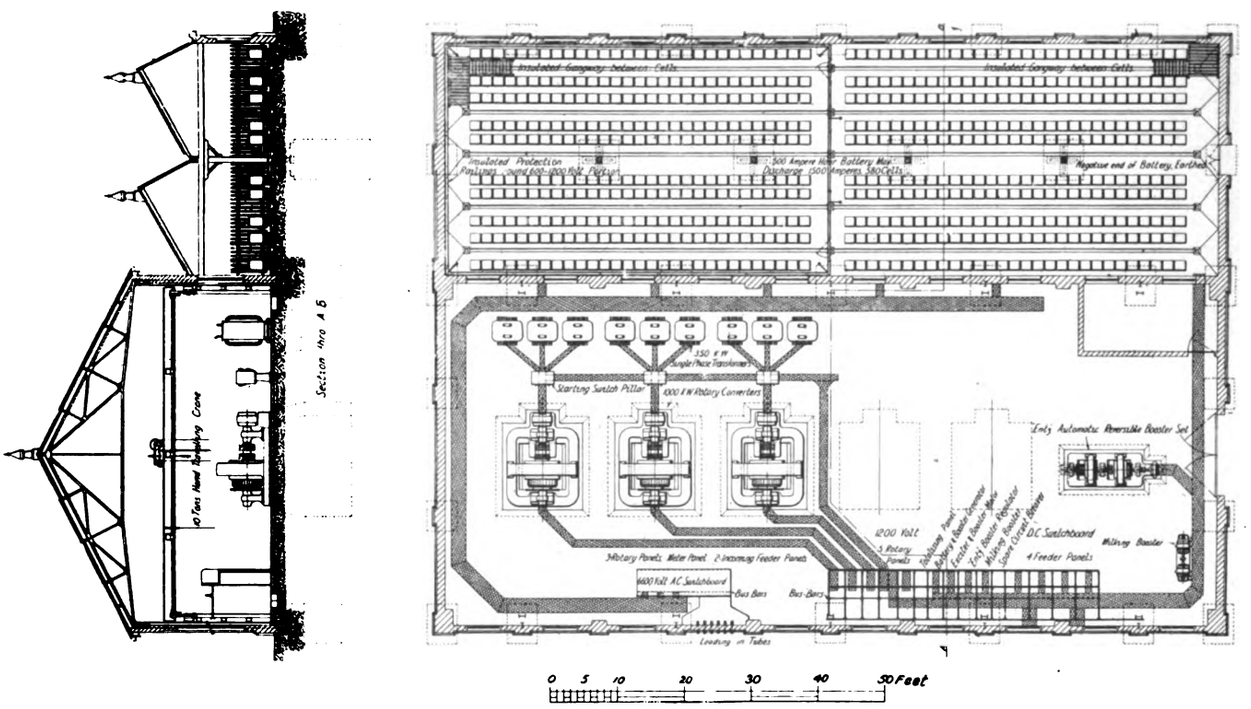

Fig. 27.—Plan and Cross Section of Radcliffe Sub-Station.

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arresters are used, but at the points where the cables enter the power-station and sub-stations, choking coils are provided.

SUB-STATIONS.

There are two sub-stations, situate at Manchester (Victoria Station) and Radcliffe, and Fig. 26 shows a diagram of the transmission from the power-station to the sub-stations, and thence to the live rail.

Each sub-station is a combined rotary and battery sub-station, the equipment in each being identical, though the arrangement at Manchester is modified slightly due to its being placed in an existing building.

Fig. 27 gives a plan and elevation of the sub-station at Radcliffe.

synchronising. No arrangements for starting from the D.C. side are provided.

Three transformers, also supplied by Messrs. Dick, Kerr and Company, Limited, are used for each rotary converter, each 350 K.V.A., and wound for a ratio of 6,600–900. They are of the oil-cooled type, and enclosed in sheet steel welded cases fitted with external tubes for radiating the heat and circulating the oil. The tubes are welded into position, and this gives a perfectly oil-tight case. The terminals for both primary and secondary leads are brought up through porcelain insulators at the top of the case, and connections are made on the high tension side through short leads and trifurcating boxes to the three-core

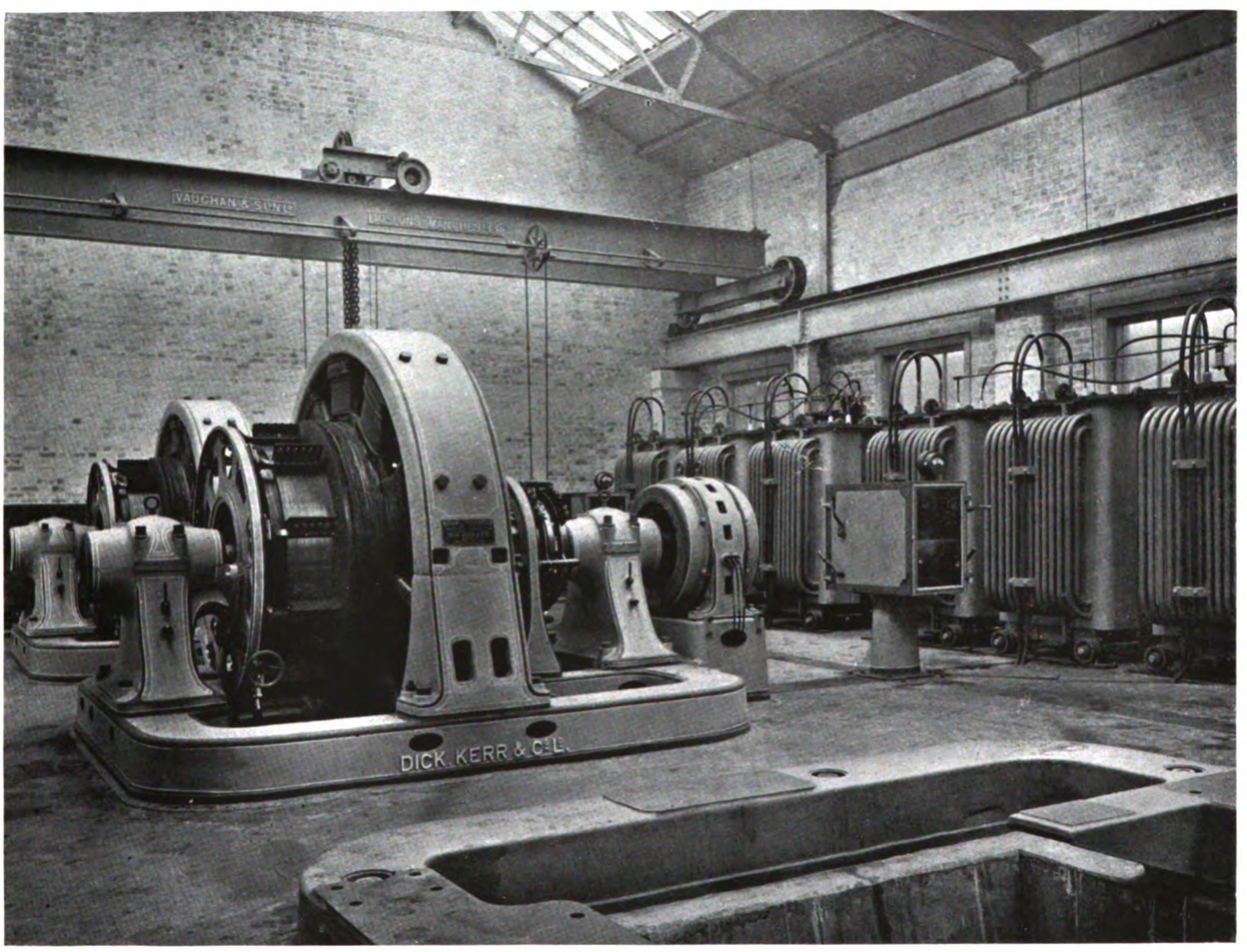

Fig. 28.—1,000 kw. Rotary and Transformers in Sub-Station.

Rotaries.—Each sub-station is equipped with three rotary converters, manufactured by Dick, Kerr and Company, Limited, Preston (Fig. 28), of 1,000 KW., six-phase, 25 cycles, 10 poles, and 300 revolutions per minute. The overload capacity of each is 100 per cent. momentarily, and they can be run continuously at 25 per cent. overload. They are arranged with an induction motor on the end of the main shaft for starting and self-

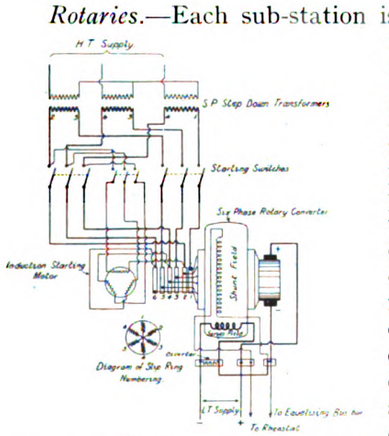

Fig. 29.—Diagram of Connections of Rotary Converter and Starting Motor.

cables from the high-tension switchgear. The low-tension leads are taken to the starting pillar and thence to the rotary. The diagram of connections is shown in Fig. 29.

Battery.—An Entz booster of the automatic reversible type with carbon regulator, made by Mather and Platt, Limited, for the Chloride Electrical Storage Company, Limited, is installed in the rotary room. This consists of three continuous-current machines, booster, motor and exciter, coupled together and mounted on one bedplate, giving an output of 900 amperes, 185 volts continuously, and will give 2,000 amperes at 190 volts for 15 seconds. Its output for charging the battery is 300 amperes at 300 volts continuously, and the voltage can be raised to 400 for over-charging. These latter ratings are obtained by hand regulation.

The booster is shunt wound and is excited from the exciter for automatic working, and from a portion of the

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battery for hand regulation. The exciter is shunt wound and is separately excited from a portion of the battery. Its excitation is controlled by means of an automatic carbon regulator, connected up on the principle of the "Wheatstone Bridge" and operated by the main generator output. The exciter is capable of exciting the booster fully when the latter is doing its regulating work. In order to prevent a lag in reversing, the exciter is designed to give three times the excitation voltage necessary to give the required boost, and the carbon regulator automatically throttles the excess current when the correct boost has been reached.

The motor is capable of driving the booster at all loads when running off a 1,200-volt circuit, at the speed of 520 revolutions per minute. The speed can be raised to 650 by means of a shunt regulator in order to obtain the overcharge voltage. The set is provided with a device suitable for breaking the circuit of the motor when the speed of the set exceeds a definite amount.

All the cables from the switchboard to the rotaries, transformers, boosters, etc., are carried in concrete ducts in the flooring of the sub-station. These ducts are covered in by steel non-slip plates.

The battery, which is housed in a separate building outside the rotary building, consists of 580 Plantide cells, manufactured by the Chloride Electrical Storage Company, Limited, Clifton Junction. The capacity is 500 ampere-hours on the one-hour rating, and the charging current can be raised up to 1,500 amperes for 15 seconds.

Each cell is contained in a pitch pine box lined with sheet lead, and this box is of such a size that the capacity of the battery can be increased ultimately to 800 ampere-hours by the addition of more plates. The positive plates are of the "formed" type, and the negative plates are of the "box" or "cage" type, each plate consisting of an "antimonial" lead cage in halves, rivetted together. The plates are perforated and the active material held in pockets. The plates are separated by wooden dowels, which also act as a support, and are suspended on stout glass slabs resting on the bottom of the cell. The stands are of pitch pine, protected by anti-sulphuric paint, and are supported on strong porcelain insulators.

Each battery is divided into two portions, which are connected through an isolating switch. The high voltage portion (600–1,200) is partitioned off by wooden railings with gates, which are kept locked, so that access can only be obtained by authorised persons. The cells of this portion are protected by wooden rails mounted on insulators; wooden gangways, which are also mounted on insulators, are placed between the cells. This arrangement has been carried out to prevent accidental shock of over 600 volts.

When it is required to carry out work on this portion of the battery, the isolating switches are used, which reduces it to the same condition as the low voltage half.

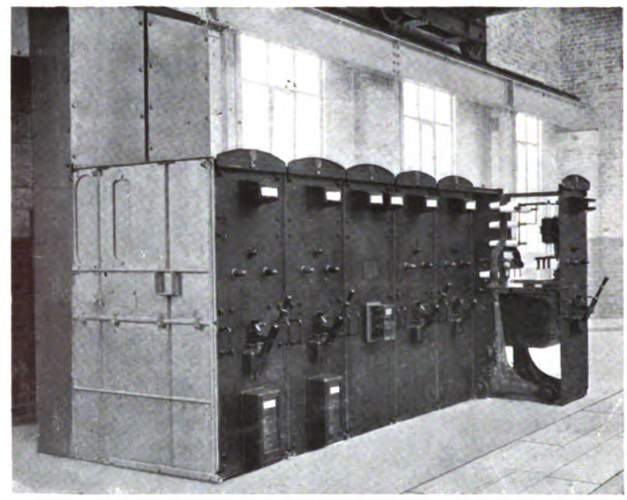

Fig. 30.—View of Alternating Current Board.

A combined charging and milking booster, manufactured by Messrs. Mather and Platt for the Chloride Electrical Storage Company, for the battery, is also installed in the rotary room, and consists of two continuous current machines—one motor and one generator—coupled together. This set is capable of charging the cells, fifty in number, which are connected to the Entz booster, in two hours a day, charging 25 cells at a time, and giving 45 ampere at 40-70 volts. The motor is suitable for working on a 1,200-volt circuit, and the booster is arranged for exciting from the cells to which the Entz regulator is connected. The set is also capable of milking the cells with an output of 200 ampere at 2 to 14 volts.

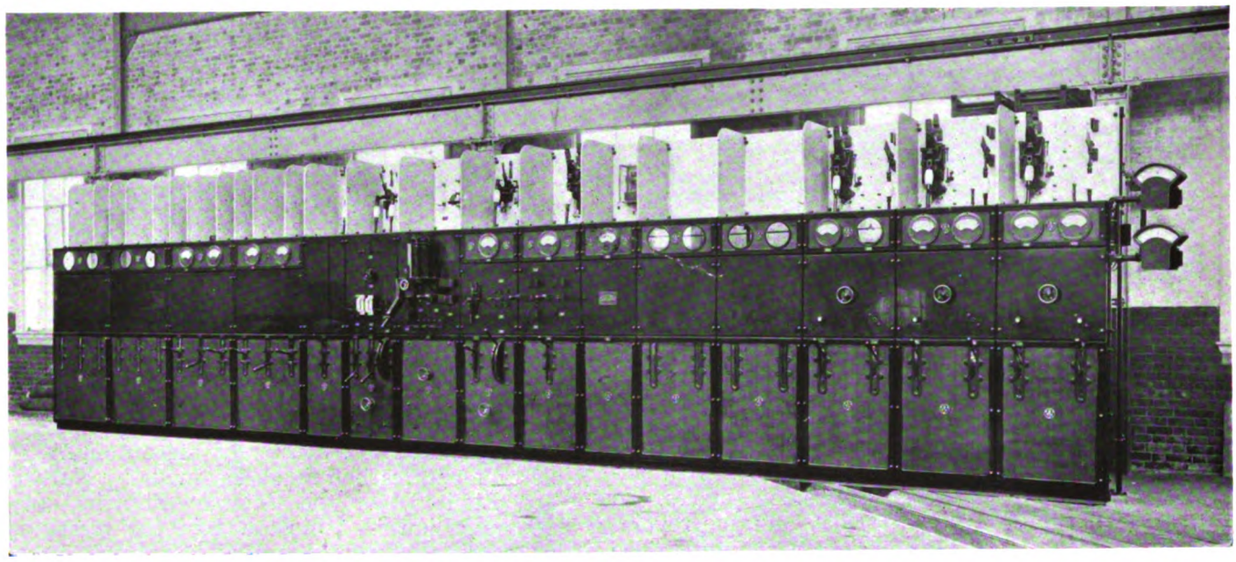

Fig. 31.—Direct-Current Switchboard in Sub-Station.

Switchgear.—The switchgear (Figs. 30 and 31) has been supplied by the British Thomson-Houston

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Fig. 32.—View showing Position of Live Rail and Fourth Rail.

Fig. 33.—Position of Live Rail and Fourth Rail at Radcliffe Junction.

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Company, and is in two parts, one of the "cubicle" type controlling the high-tension feeder and transformer leads, and the other of the "flat-board" type controlling the D.C. rotaries, battery, booster, and live rail. Both boards are placed on the ground floor of the station. The high-tension apparatus is contained in six cubicles, Nos. 1 and 2 controlling the duplicate feeders, No. 3 being the bus-bar potential feeder, and Nos. 4, 5, and 6 controlling the transformers for the three rotary converters. The feeder and high-tension cubicles each contain a hand-operated oil switch, the connections to the bus-bars being made through switch clips at the back. The arrangement is such that the whole of the apparatus can be withdrawn from the cubicle for inspection purposes, interlocking devices being used to prevent the apparatus being withdrawn or replaced, when the oil switch is closed.

The D.C. board, being 1,200 volts, is arranged so that there is no live contact on the front of the board, the main switches and circuit breakers, and all 1,200 volt apparatus being placed above the board in cubicles divided from each other by partitions (Fig. 31). This board consists of fifteen panels, 4 ft. × 15 ft. high. All the switch gear is mechanically operated by insulated levers on the lower panels. The rotary panels each include a circuit breaker, a single pole quick break switch, a field ammeter, a main ammeter and rheostat. The total output panel includes an integrating wattmeter and a main ammeter.

The feeder panels are two in number; one controls the live rails on one side of the station and the other the live rails on the other side of the station. The up and down live rails in each case are independently controlled by a knife switch, but one circuit breaker governs both up and down live rails in one direction. The battery booster panels contain the necessary switchgear for operating the booster and the main battery, also the milking booster.

The Track.

Though the system adopted is the third or live rail with track return, augmented by a fourth rail, considerable departure has been made from the previous practice, in that it is a side running contact instead of over or under running. This has been brought about by the fact that 1,200 volts necessitates more adequate protection against shock, and the form of rail adopted is admirably adapted for guarding. This, of course, also applies to the under-running type, but here the objection was the small clearances available.

The live rail and its guarding, also its relative position to the track rails, shown in Figs. 34 and 37, is the invention of Mr. J. A. F. Aspinall, the general manager of the railway company. It is very compact, lies close to the running rail, and gives the maximum space for platelayers and other workmen in the six-foot where the rails are normally fixed. The guarding is of Jarrah, which has been adopted for its non-combustible qualities. It is held in position by clips secured by ordinary chair keys, no screws or nails being used.

The section of the rail has been designed so that its centre of gravity is well within the base line. The rail has been supplied by the Shelton Iron, Steel and Coal Company, Ltd., Stoke-on-Trent, and is of a special design. The arrangement is such that a projection on the upper portion of the insulator acts in conjunction with the guarding as a key which keeps the rail in position. The insulator itself is kept in position by three small brackets. The rail, however, does not rest directly on the porcelain insulator, but a wooden packing is inserted between to act as a buffer. The normal spacing of the insulators is approximately 12 ft. The live rail is anchored every one hundred yards by a

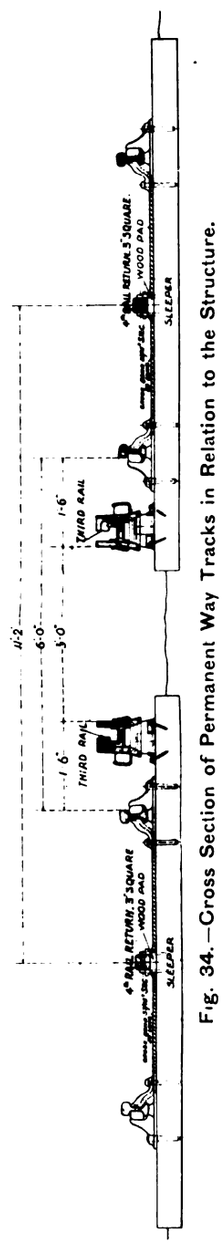

Fig. 34.—Cross Section of Permanent Way Tracks in Relation to the Structure.

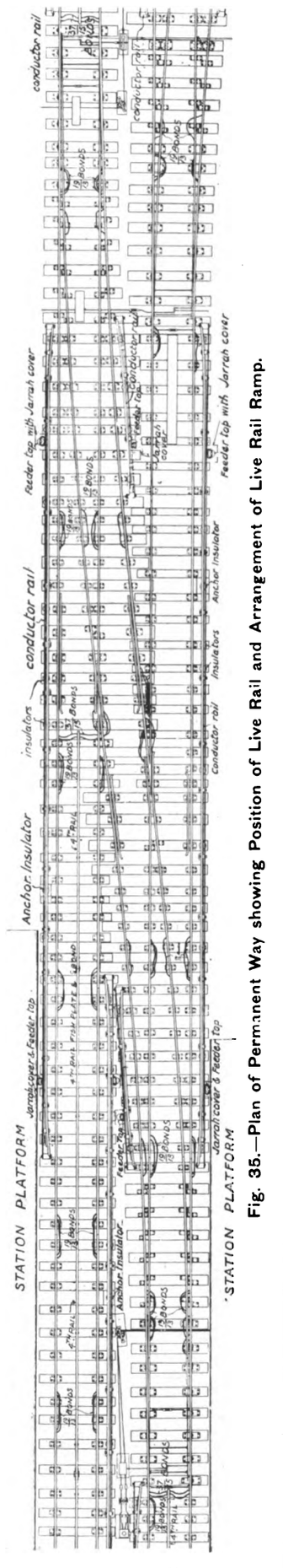

Fig. 35.—Plan of Permanent Way showing Position of Live Rail and Arrangement of Live Rail Ramp.

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specially-designed anchor insulator supplied by Messrs. Bullers, Limited.

The live rail insulators are of white porcelain, completely vitrified throughout and glazed all over, and are 6⅛ in. high. The actual creeping surface is 8 in. from metal to earth. These insulators have been supplied by Doulton and Company, Limited, of London. The cross sectional area of the rail is 8·35 square inches, and the weight 85 lb. per yard. Its resistance ranges between 6·5 and 7·0 times copper of equal area and length. The normal length of each rail is 60 ft.

The rails are bonded at each joint with two bonds, each bond having an effective cross sectional area of 0·4 square in. These bonds, which are of the strip copper flexible type, have been manufactured by the Forest City Electric Services Supply Company, Limited, of Manchester.

The chemical composition of the rail is :—

Carbon	0·08	per cent.
Phosphorus	0·034	,,
Manganese	0·22	,,
Sulphur	0·026	,,
Silicon	0·022	,,
Iron	99·618	,,

The cables used for connecting across the gaps were manufactured by W. T. Henley's Telegraph Works Company, and normally two 0·5 square in. or a single 1·0 square in. cable are used. They are insulated with vulcanised bitumen and run in wooden troughs, which are filled in with bitumen. These troughs are, as far as possible, carried above ground, as shown on the left of Fig. 33, but in all cases of underground work, "Howard" troughing is used.

The fourth or return rail is of square section with rounded corners, and it weighs 88·5 lb. per yard, with a cross sectional area of 8·84 square in., the chemical composition and electrical conductivity being the same as the live rail. This section has been adopted on account of the small surface exposed over a given volume of rail, therefore needing small maintenance in painting, etc. This rail is cut in lengths of 60 ft., and is placed between the running rails. It rests on wooden pads, 1 in. thick, secured to the sleepers by iron dogs, and is anchored at intervals of 100 yards. There are two bonds per joint, and the effective cross sectional area is 0·325 square in. per bond. They are also cross-bonded every 100 yards to the track rails with cable bonds of 37/15 S.W.G. copper, and the track rails are also bonded by cable bonds. Figs. 32 and 33 show the general appearance of the live rail and its relation to the track.

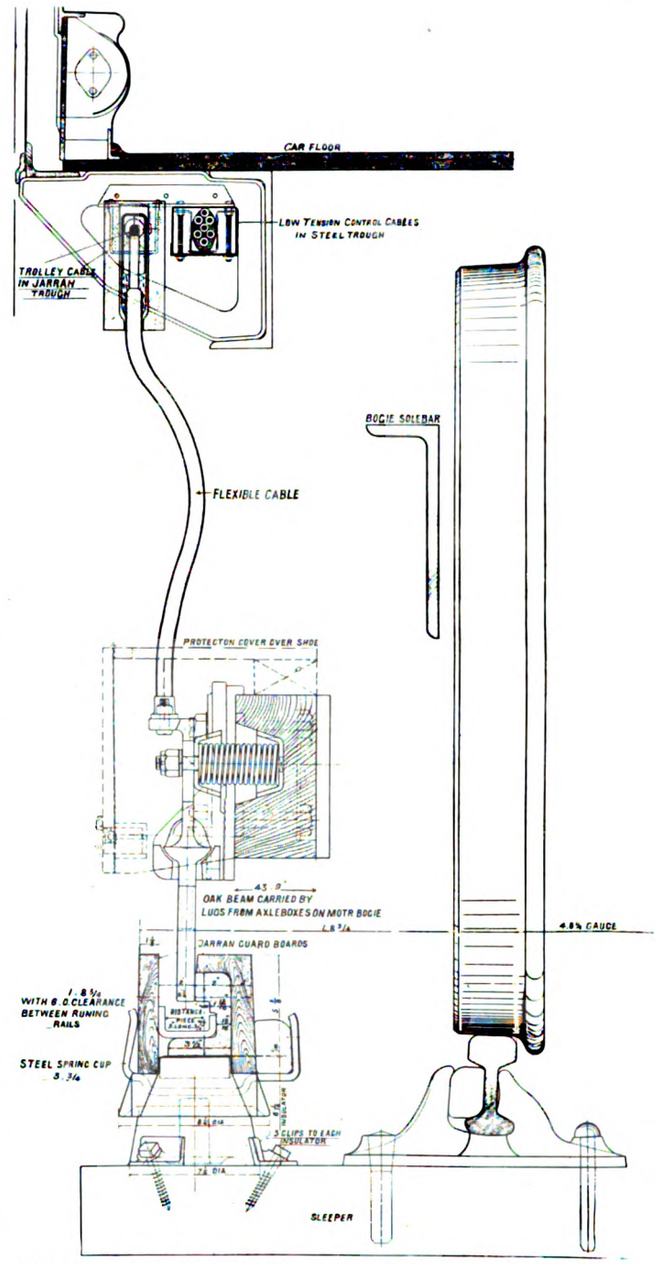

Fig. 37.—Cross Section through Conductor Rail showing the Contact Shoe and Car Trolley Connection.

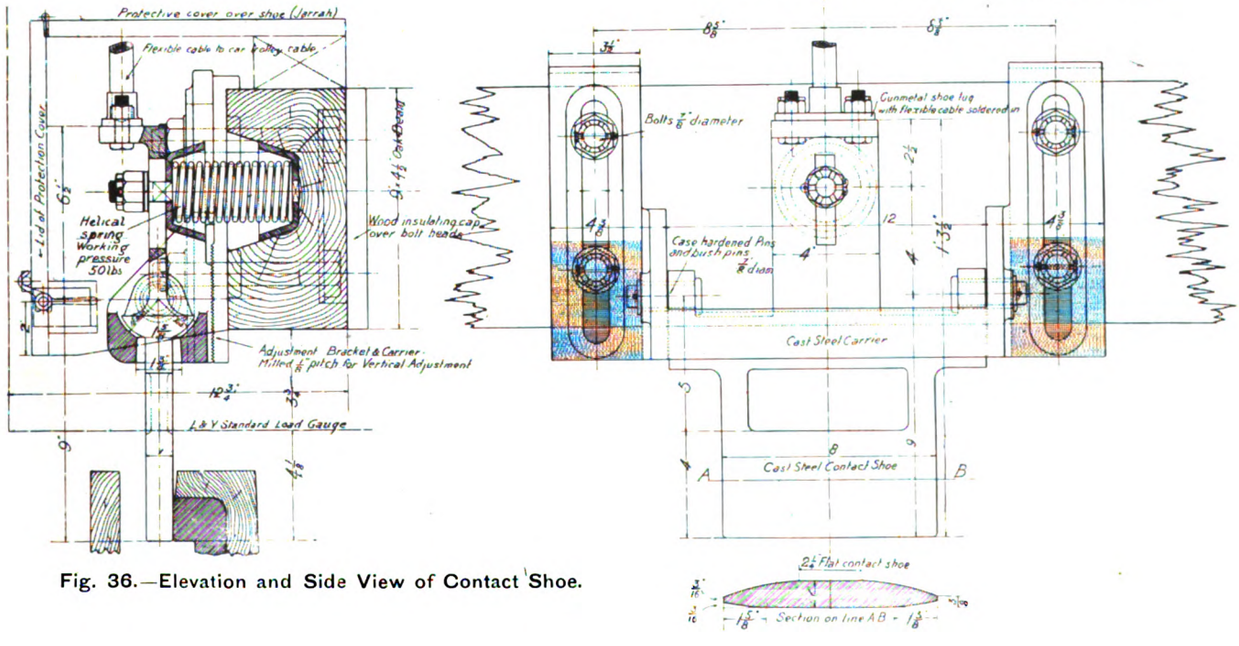

Fig. 36.—Elevation and Side View of Contact Shoe.

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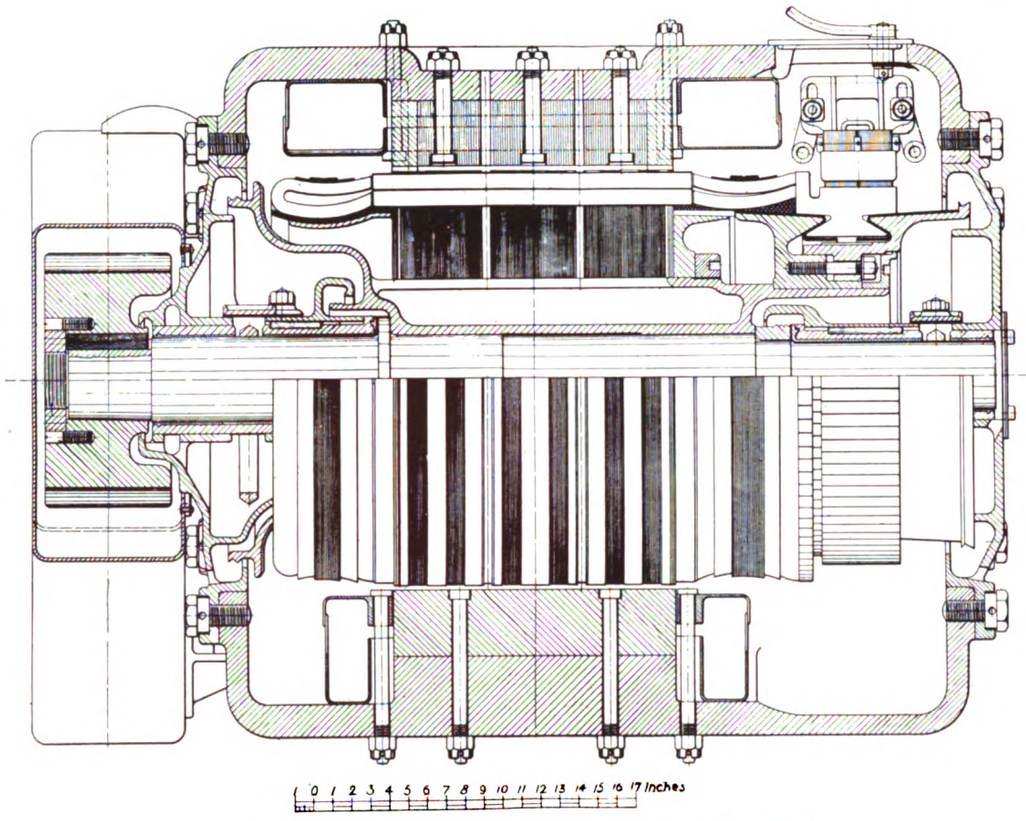

Fig. 41.—Longitudinal Section through 200-H.P. Motor.

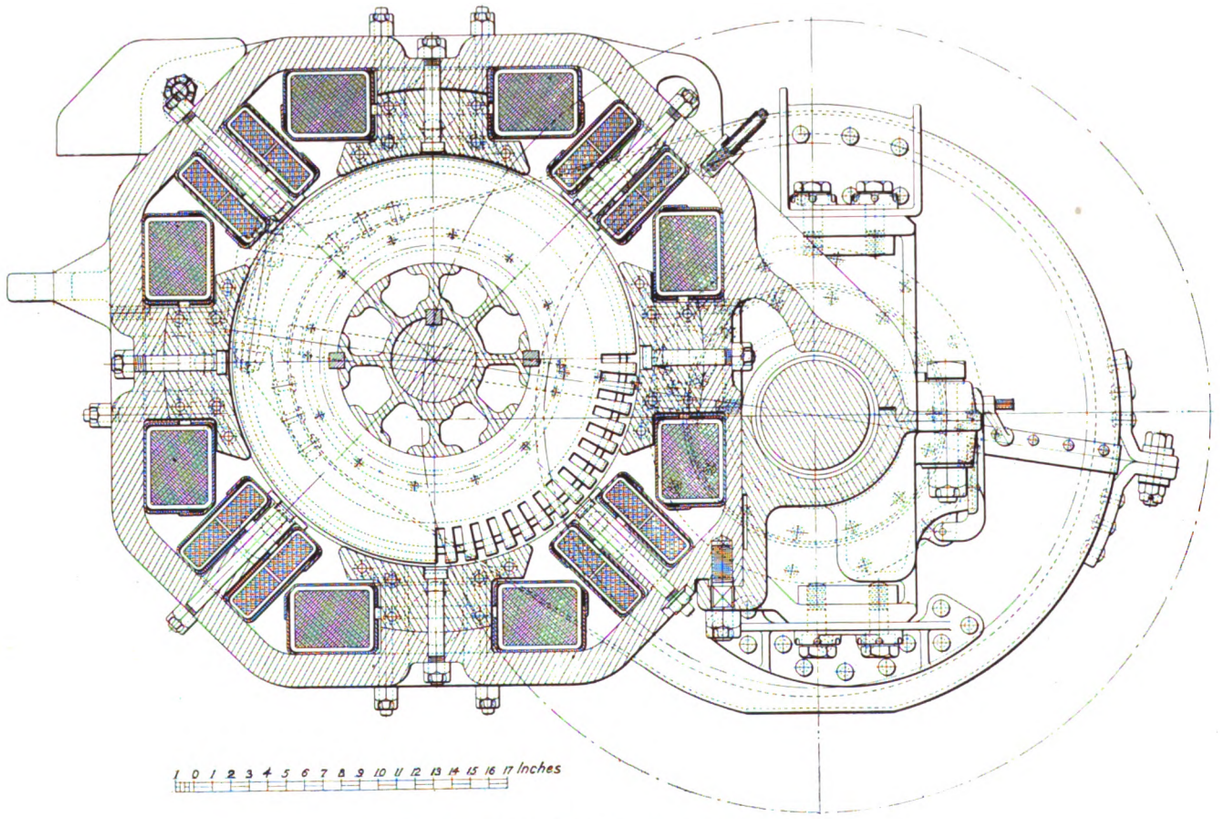

Fig. 42.—Cross Section of 200-H.P. Motor

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The track is fed from the sub-stations through short feeders, which take the shortest course from the sub-station to the track rails; no supplementary feeders are used. The live rail is divided up into sections, which are connected through section switches placed alongside the live rail, and operated as ordinary hook switches. At all gaps the live rail is ramped towards the running rail, so as to receive the shoe which runs on the outside of the rail. This ramp is shown in Figs. 32 and 35. The whole of the erection of the track equipment has been carried out by the railway company.

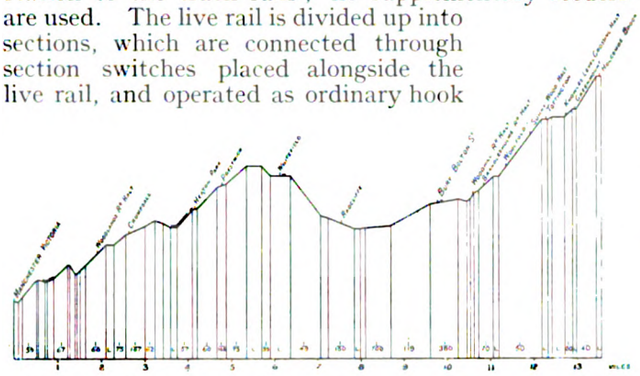

Fig. 39.—Diagram of Gradients between Manchester and Holcombe Brook.

Motors.—The motors (Figs. 40, 41, 42) are designed for 1,200 volts, series wound, with commutating poles, and are totally enclosed. The field frame is in one piece, of the "box" type, the main poles being arranged vertically and horizontally; this arrangement having been found to give the best space efficiency in the limited room available. The ventilation of the motors has been carefully considered and provided for. The armature laminations are carried on a hollow spider, which also carries the commutator. There is a free passage of air through the spider and through the ventilating gaps in the armature, which are continued through the main poles to the outside atmosphere.

The armature coils are all insulated with solid mica insulation, and the field coils are enclosed in brass cases to keep them from contact with oil. Ring lubrication is used for the armature shaft, the oil wells being of ample proportions; oil lubrication with pads is adopted for the suspension bearings. The brush gear is carried on a solid steel yoke bolted to the frame, which is insulated with solid mica, and forms a very rigid construction.

Electrical Equipment for Cars.

The control equipment on the cars is of the multiple unit system, and is arranged to be operated on the

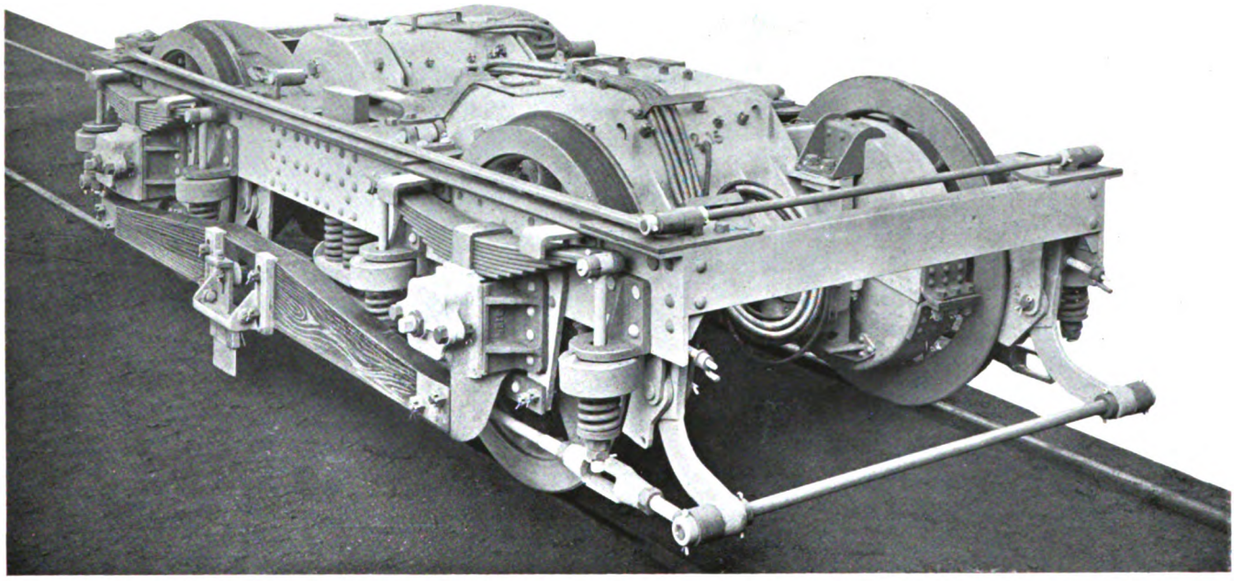

Fig. 38.—Motor Bogie Complete with Motors and Shoe.

Shoe.—The general arrangement of the shoe is shown in Fig. 36, and its connection to the trolley cable in Fig. 37. The mounting of the shoe on the bogie is shown in Fig. 38.

The Rolling Stock.

Motor Bogies.—The motor bogies complete (Fig. 38), which have been designed and built at the railway company's locomotive works at Horwich, carry two 200-H.P. motors mounted and geared to the axle through spur gearing, the ratio being 25/59, or 2·36 to 1·0. On each side of the bogie is mounted a shoe beam, carrying the collecting shoe.

Each motor car is provided with two of these bogies, making a total of four motors, or 800 H.P. per car, the gradients being somewhat severe, as will be gathered from Fig. 39. The wheel base is 9 ft., and the diameter of the wheels 3 ft. 7 in., the wheels being of standard locomotive pattern. There are two brake shoes per wheel.

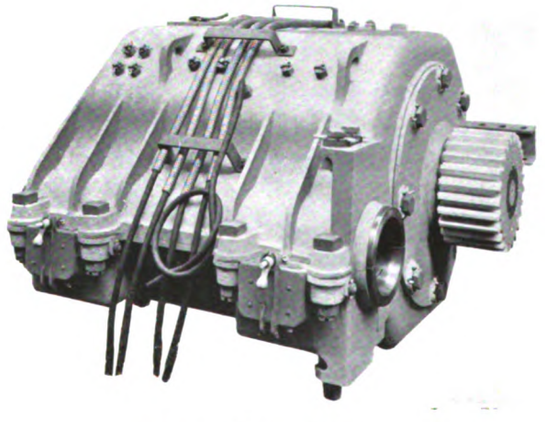

Fig. 40.—200-H.P. Motor.

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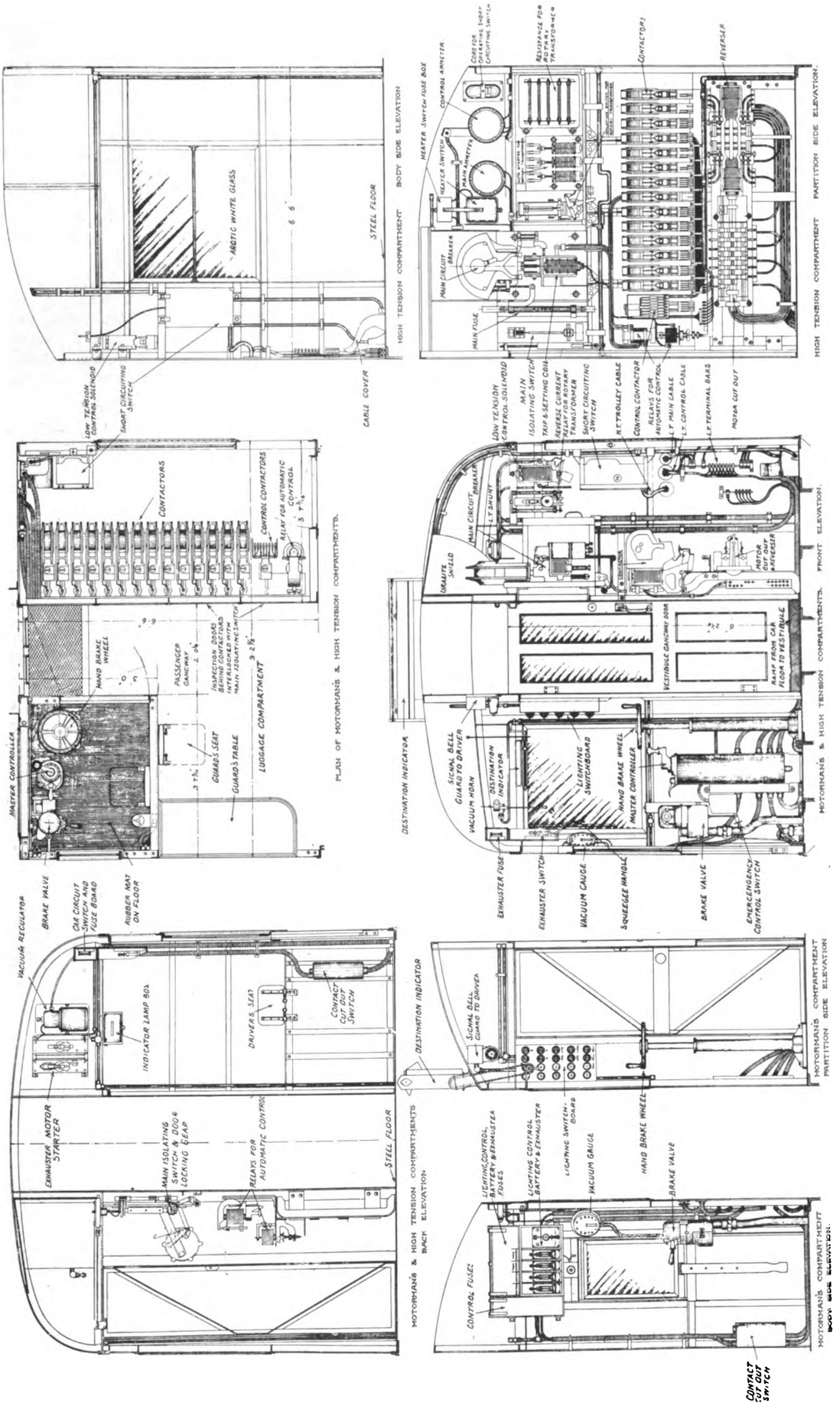

Fig. 43.—Interior of Motorman's and High Tension Compartments.

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automatic principle, that is, instead of the motorman notching up in the usual way by hand, he puts his controller into the "full series" or "full parallel" position, the various intermediate steps being performed automatically. It can also be operated by hand by simply moving the reversing lever to a certain position. The control equipment on each car is capable of controlling the four 200-H.P. traction motors, with a line voltage of 1,200, to give "series parallel" and "parallel" combinations of the motors.

The whole of the equipment is operated by 100 volts D.C. current, which is transformed from the line voltage (1,200) by means of a rotary transformer mounted under the car. All the 1,200-volt equipment is housed in a special high-tension chamber, the door of which is interlocked so that the isolating switch connecting the control leads from the shoes must be opened before entrance can be effected.

The arrangement of the motorman's compartment, and the high-tension compartment, is shown in Fig. 43. All the contactors, the reverser, and the motor cut-out are mounted on the inner wall of the high tension compartment, opposite the window, and above these are mounted the isolating switch, main fuse, main circuit breaker, and in an auxiliary high-tension chamber is the starting gear for the rotary transformer with its isolating switch. The high-tension wiring is carried in flexible steel tubing.

The motorman's compartment contains a brake valve fitted with an emergency handle which on release applies the brake instantly, and also trips the control circuit, thereby opening all the contactors, a master controller and a hand brake, together with the switches for lighting and the necessary switches and fuses for the control and brake. It also contains the automatic controller and regulator for the vacuum pump. The arrangement shown is the same at each end of the motor car, with the exception of the brake pump controller and regulator.

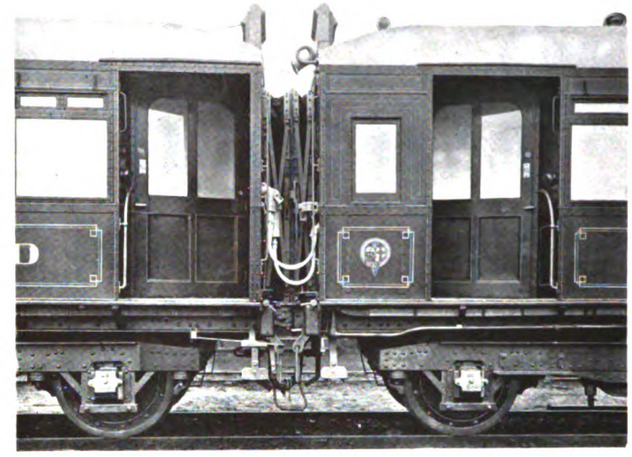

Fig. 45.—Coupling, Vestibule and Side Couplers.

The reverser handle on the master controller has four positions, reading from right to left, "reverse," "off," "ahead automatic control," and "ahead manual control." It will be noticed that one of the positions is "ahead manual control" (Fig. 43). This is used in

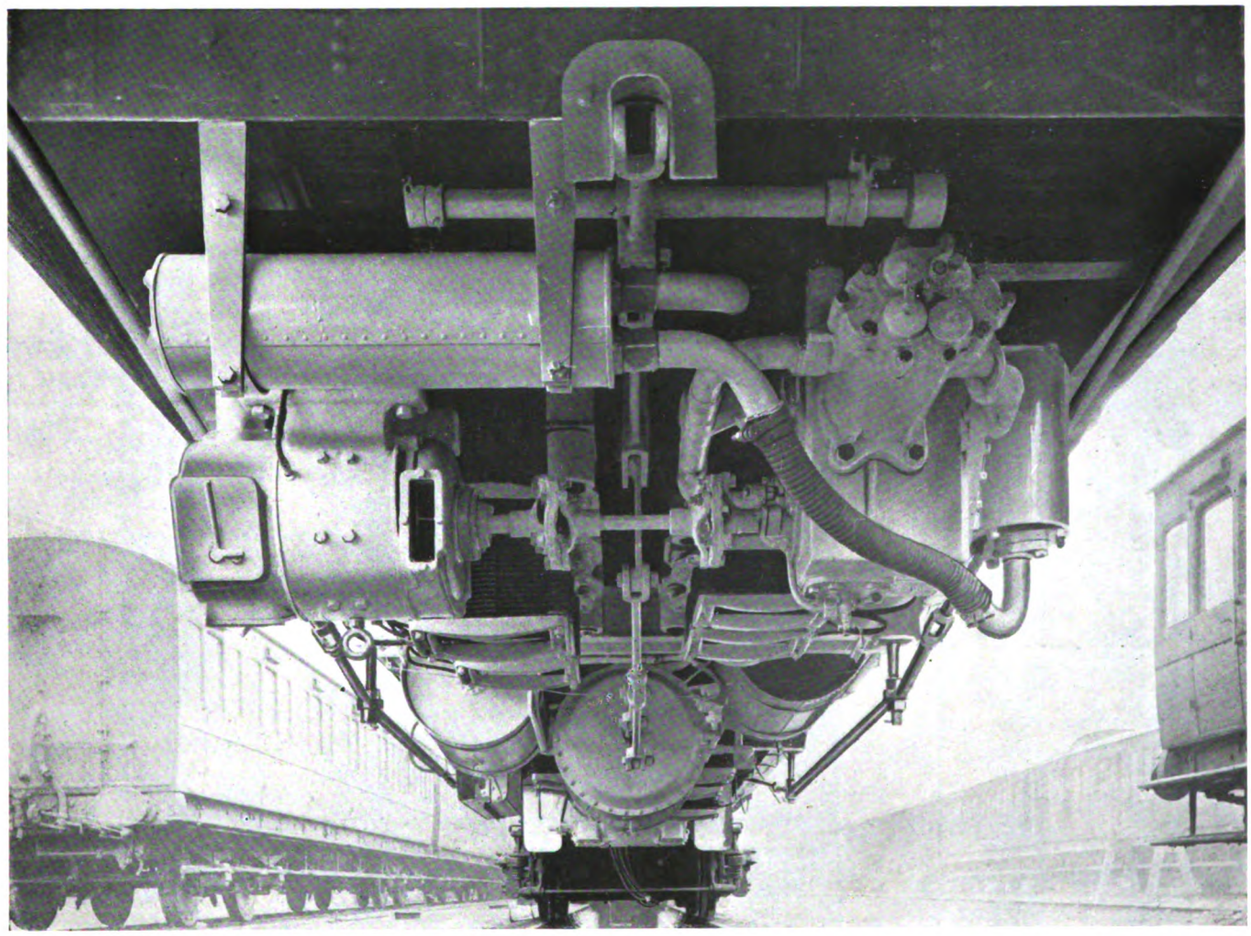

Fig. 44.—Underside of Motor Car.

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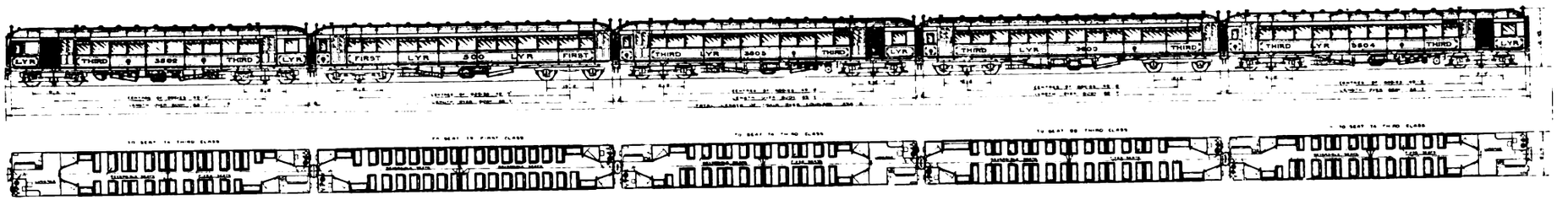
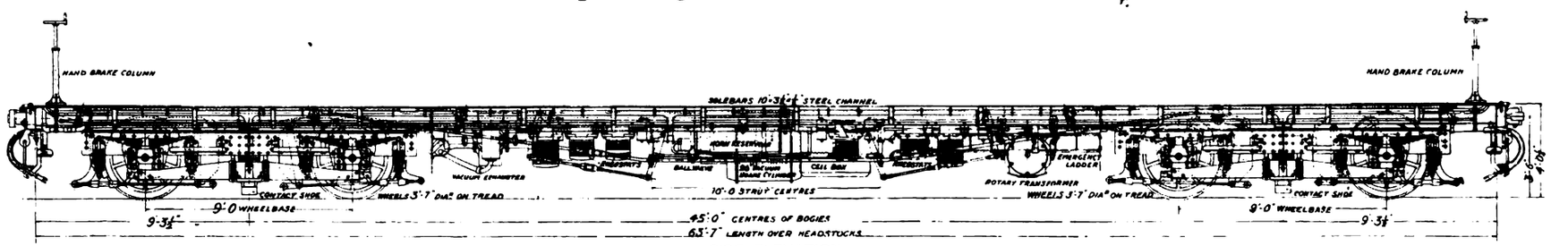
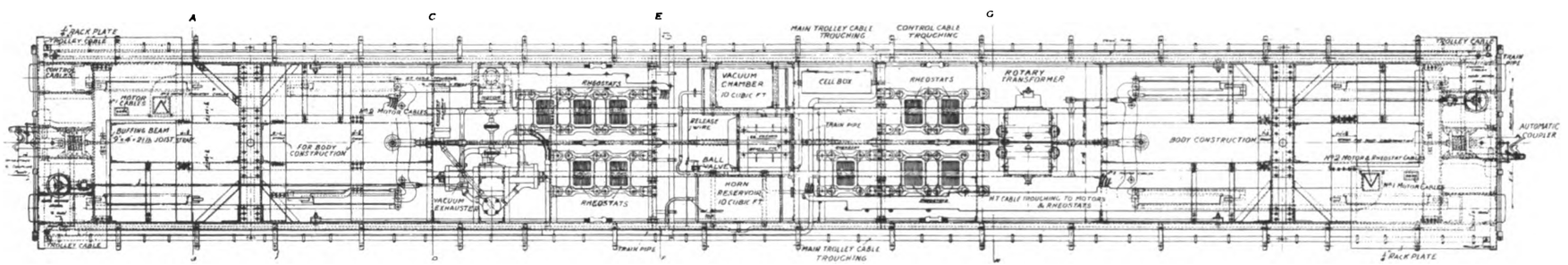


Fig. 46.—Diagram of Five-Car Electric Train.



SIDE ELEVATION.



PLAN.

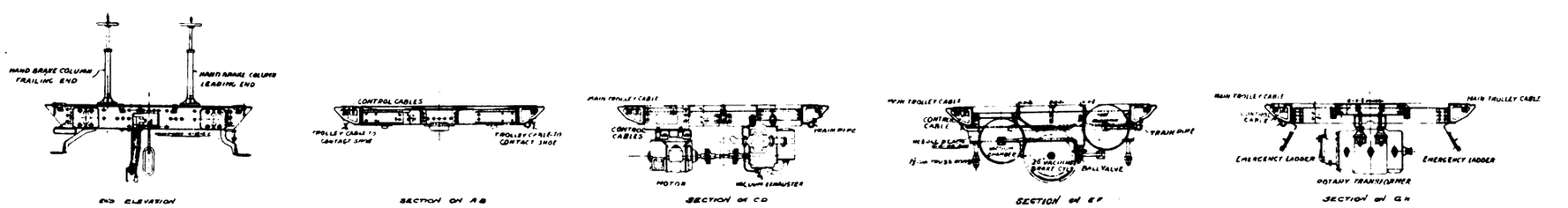


Fig. 47.—Motor Car Underframe.

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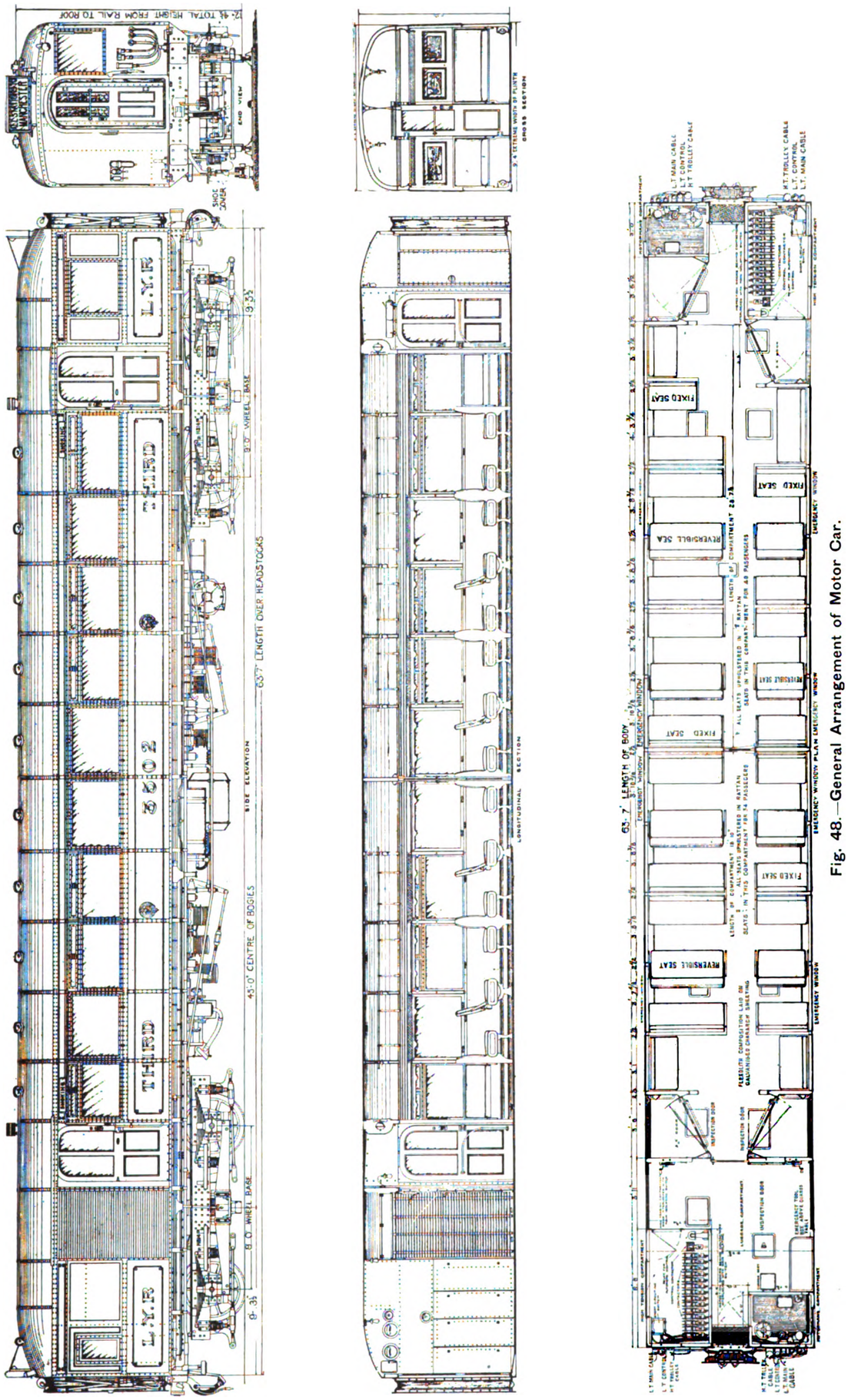

Fig. 48.—General Arrangement of Motor Car.

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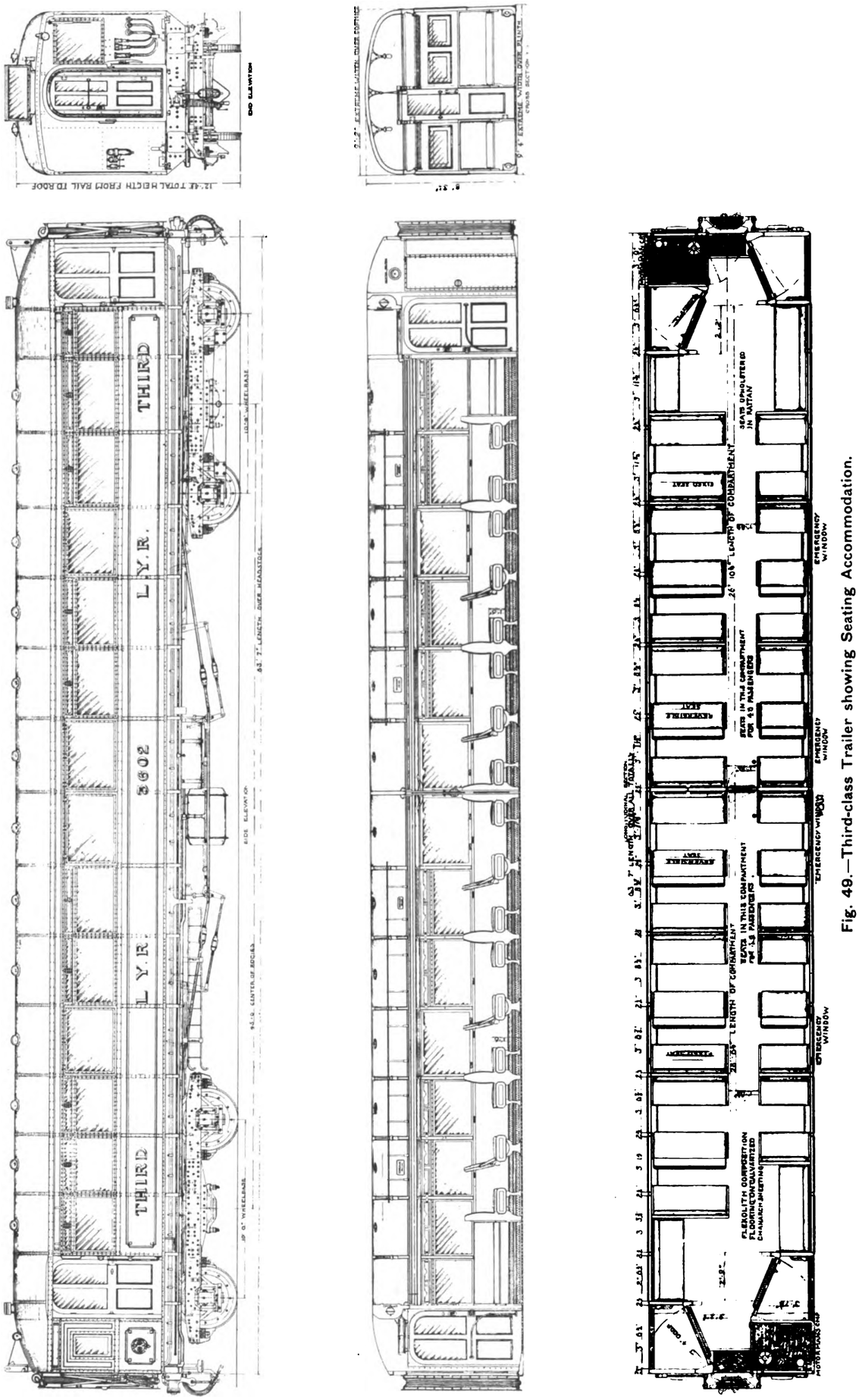

Fig. 49.—Third-class Trailer showing Seating Accommodation.

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case of emergency due to failure of the "automatic control." Normally this is a stop which is sealed, and which prevents the reverser handle being placed in the manual position.

There are four series points on the controller, three intermediate and three parallel, with an additional two positions by which the field of the motors is shunted when higher speed is required for express traffic. All the cables with the exception of the trolley cable are carried in sheet steel troughs; the trough for the trolley cable is made of "Jarrah."

Each equipment consists of fourteen contactors, which are of the "Hammer" type, with a rolling action, and are fitted with special soapstone dished arc-horns for receiving the arcs. The control equipment has been supplied by Messrs. Dick, Kerr and Company, Limited.

Brake.—The brake is the standard automatic vacuum brake, so that if necessary ordinary steam trail cars can be coupled to them, the brake still being effective.

The vacuum is produced by means of a twin-cylinder exhauster, driven through gearing by a Mather and Platt 5-H.P. 100-volt motor. This arrangement is shown in Fig. 44, which also shows the brake cylinders and the resistances. In arranging the apparatus underneath the car, careful consideration has been given to accessibility for maintenance purposes. The heating is operated off the 1,200-volt circuit, and the lighting, pump motor, and control off the 100-volt circuit. The trolley cables, of which there are two, one on each side of the car, are continuous throughout the trains, connections being made through couplers, as shown in Fig. 45. This figure also shows the multiple couplers for the control and the coupler for the bell and brake exhauster control.

each end of all cars, which enables the trains to be made up to any accommodation required with the minimum of shunting operations.

Figs. 46 and 56 show a five-car train; Fig. 47 shows the underframe, Fig. 48 the general arrangement of a motor car, and Fig. 51 an outside view; and Figs. 55 and 49 an outside view of a first-class trailer, and the general arrangement of a third-class trailer respectively. The bogie for the trailer is shown in Figs. 50 and 51.

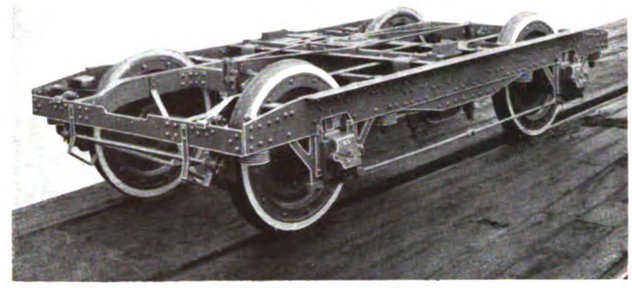

Fig. 50.—Trailer Car Bogie.

From a public point of view the most interesting feature is that timber has been entirely superseded by metal in the construction of these cars, the vehicles being therefore entirely fireproof. The framework is of steel, the panelling of the sides and roof is made up of aluminium sheets, the interior work being finished with mouldings of drawn steel and aluminium sections. The net rod brackets, air extractors and electrical fittings, together with all inside furniture of both

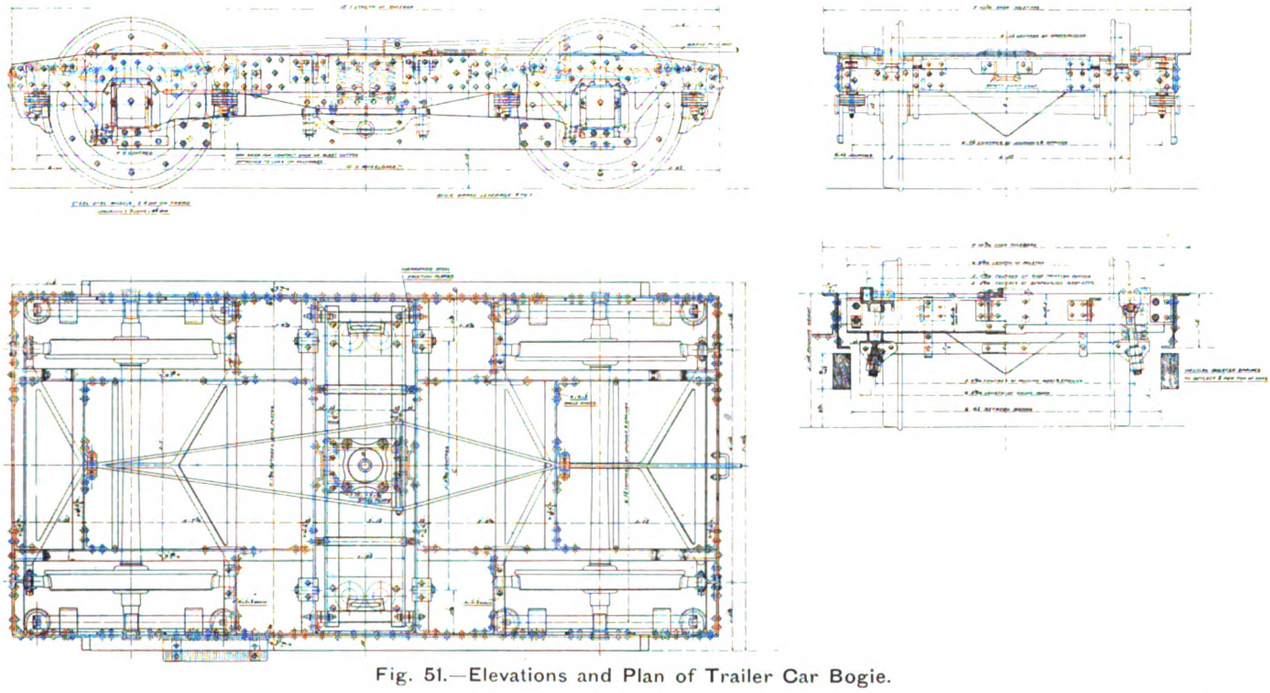

Fig. 51.—Elevations and Plan of Trailer Car Bogie.

All-Metal Rolling Stock.

The electric trains for this service have been built at the company's carriage and wagon works at Newton Heath, and consist of either two, three, four, or five bogie cars, according to the requirements of traffic; but the standard train will have five cars, the front, centre, and rear vehicles being third-class motor cars, and the intermediate vehicles first and third class trailers. A feature of the design is that the compartment for the accommodation of the driver is at

first and third class cars being in polished aluminium. The doors are of steel and of the simplest design.

The all-metal car has largely been introduced in America, and to some extent in this country, but hitherto the term has been somewhat of a misnomer, as timber has been largely used for windows, seats, packings, and other fittings. It is therefore a point of some importance that the new cars on the Manchester and Bury electric line will actually be fireproof.

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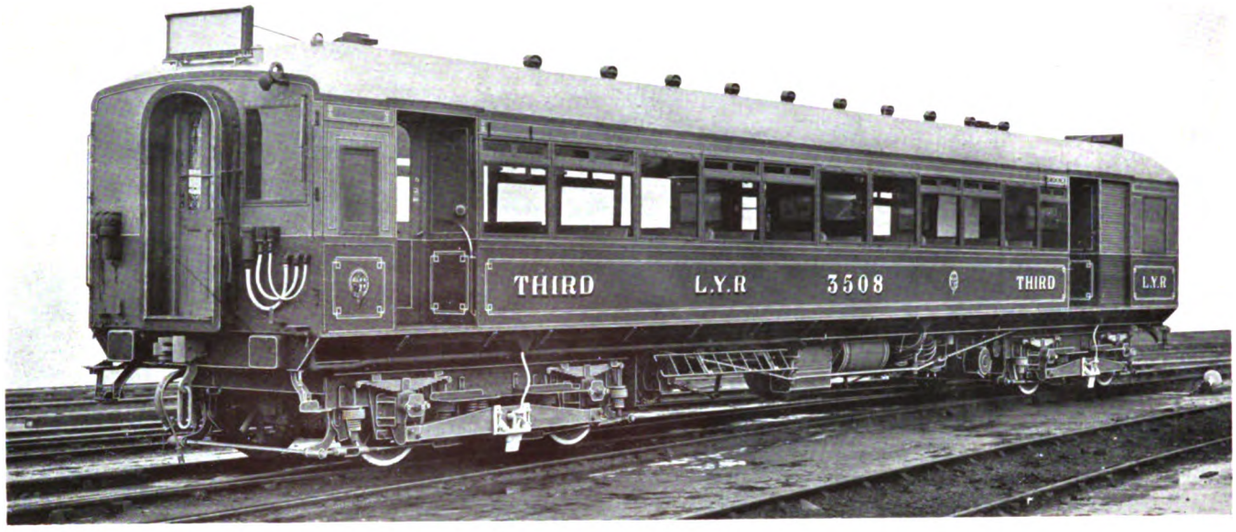

Fig. 51.—A Motor Car.

Fig. 52.—Interior of First-class Car.

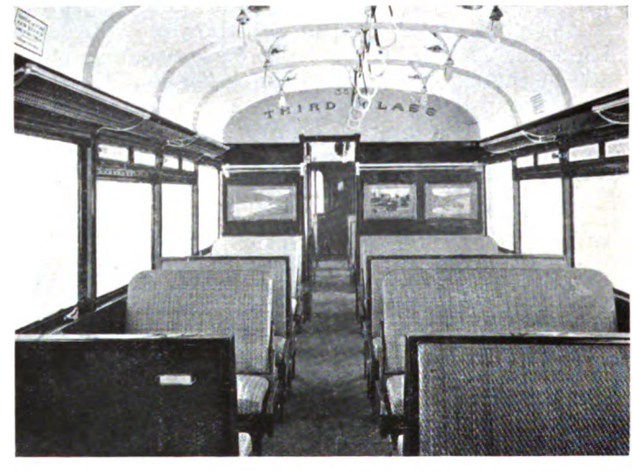

Fig. 53.—Interior of Third-class Motor Car.

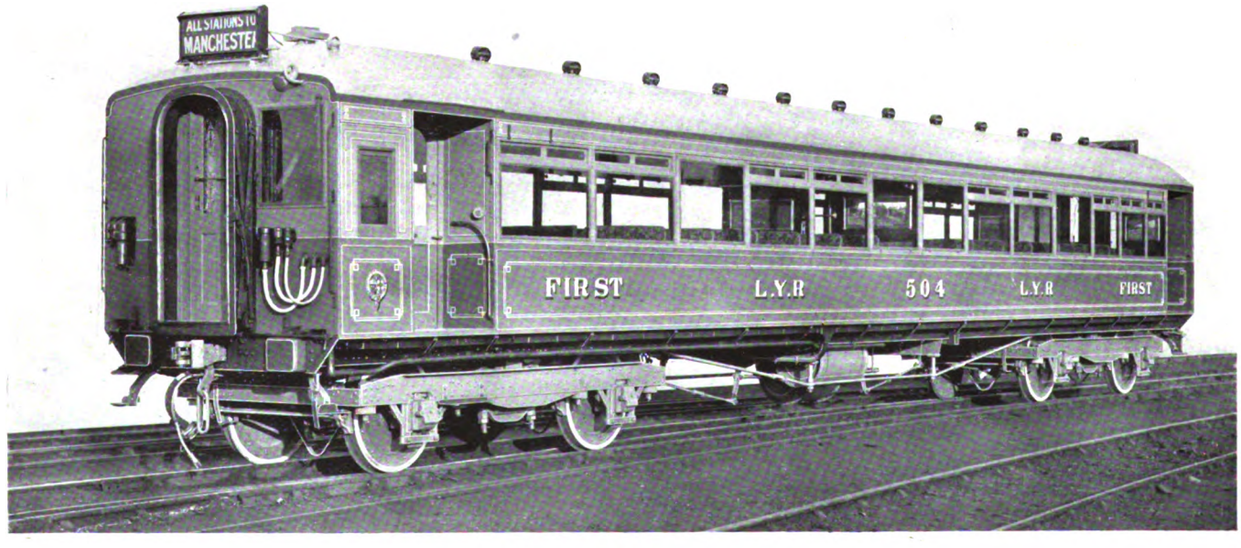

Fig. 55.—First-class Trailer Car.

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The following are particulars of both the motor and trail cars :—

Total length of five-car train (over all) ...	326 ft. 3 in.
Seating accommodation of five-car train :—First-class, 72 ; third-class, 317 ... ... total... ...	389
Length over body	63 ft. 7 in.
Length over couplers	65 ft. 3 in.
Height ftom rail to top of roof	12 ft. 4½ in.
Centre to centre of bogies	45 ft. 0 in.
Wheel-base of motor car bogies	9 ft. 0 in.
Wheel-base of trail car bogies	10 ft. 0 in.
Total weight of five-car train	220 tons.
Weight of motor car	54 tons.
Weight of trail car	29 tons.

The vehicles have been designed with a slight taper on the sides of the bodies, and with elliptical roofs, the cars having large side lights and fan lights. The flooring has been built up of Keystone or Chanarch galvanised sheets, which are rivetted to the steel underframe, and on these sheets is laid Flexolith or Decolite composition.

The cars are entered at the extreme ends of each vehicle, through vestibules, while gangways are provided throughout the trains so that passengers can pass from one car to another to secure a seat. A feature of note is that the usual stepboard used on most British trains is dispensed with, and passengers will be able to enter the vehicles direct from the station platform without making the usual intermediate step, which will be a decided advantage in quickening the ingress and egress of passengers at the stations.

Each car is divided into two main passenger compartments with a centre aisle, fixed and reversible seats being arranged alternately on either side ; the first-class seats being upholstered in tapestry and the third-class in rattan (Figs. 52 and 53).

Other interior fittings of importance are the arrangement of electric lighting and heating. The former gives an excellent distribution of light and the latter, arranged in ducts along each side of the car at the floor level, ensures comfort in the coldest weather. Electric fans are also fitted, and by means of a two-way switch they can supply fresh air from the outside, or extract foul air from the inside of the car. Sanitary strap hangers, for rush periods, are provided in the third-class cars, and are secured to the roof by aluminium brackets. The painting of the outside of the cars is in the standard colours of the company, whilst the interior is finished in self colours, the lower part in dark brown, from the waist panels to the cornice in a restful shade of green, and the roof being of white. Large panorama photographs of places of interest complete the artistic effect of the inside decoration.

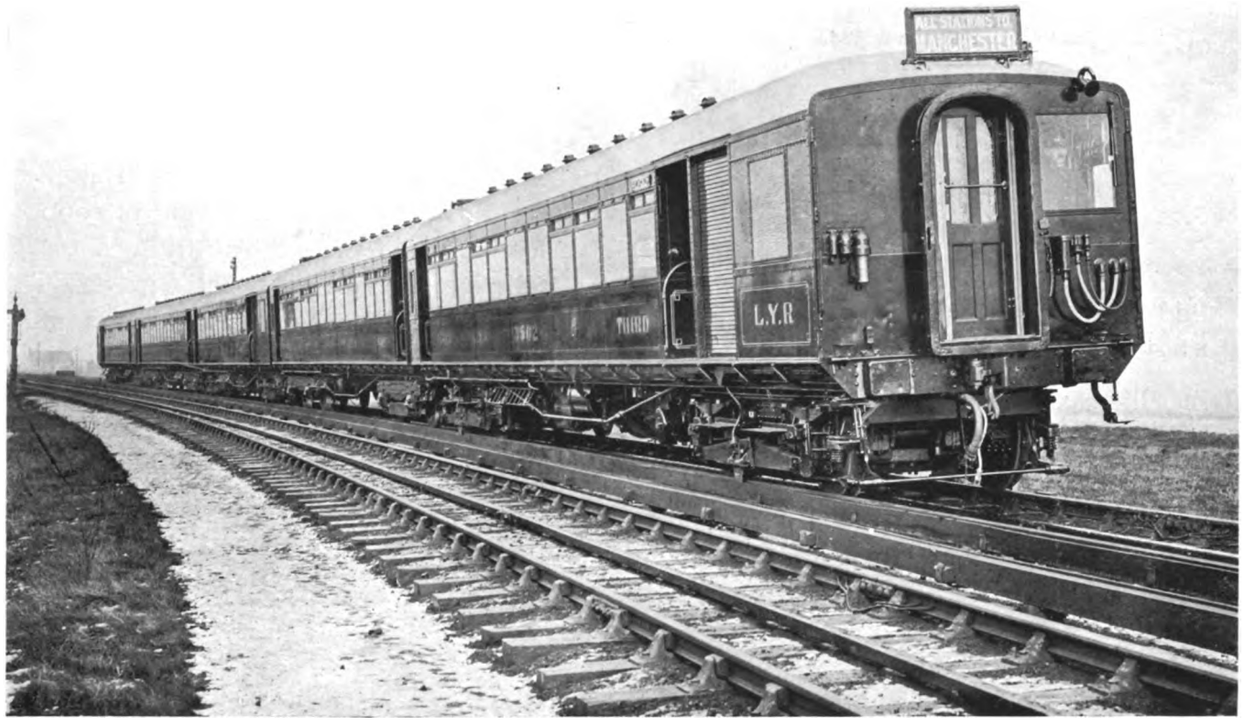

Fig. 56.—Five-Car Train on 1,200 Volt Direct-Current Section of the Lancashire and Yorkshire Railway.

UNDERGROUND AND OMNIBUS COMPANIES.

In accordance with the power obtained last session under the London Electric Railways Facilities Bill, the directors have published the particulars of a proposed pooling agreement, under which the surplus earnings of each of the contracting parties will be paid into a common fund each half-year, to be distributed in the following proportions :—City and South London, 6 per cent.; Central London, 20 per cent.; London Electric, 30 per cent.; Metropolitan District, 12 per cent.; London General Omnibus, 32 per cent.

In each case the surplus will be the earnings remaining after payment of all prior charges, including interest on preference stocks and making due allowance for depreciation and reserve.

Every pooling agreement made under the Bill must be deposited with the Board of Trade, and if the Board of Trade so order must be published in such manner as the Board may direct.

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THE
Tramway and Railway World

FOUNDED IN 1892 AND PUBLISHED BY
THE TRAMWAY AND RAILWAY WORLD PUBLISHING COMPANY, LIMITED,
AMBERLEY HOUSE, NORFOLK STREET, LONDON, W.C.

SUBSCRIPTION:

THE TRAMWAY AND RAILWAY WORLD can be obtained, post free, at the following rates:

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THE ANNUAL SUBSCRIPTION INCLUDES 64 ISSUES, OF WHICH 12 ARE ILLUSTRATED NUMBERS.

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THE EDITORIAL AND PUBLISHING OFFICES OF
THE TRAMWAY AND RAILWAY WORLD
ARE AT AMBERLEY HOUSE, NORFOLK STREET,
LONDON, W.C.

Telegraphic Address: "TRAMIGRO, LONDON."
Telephone No.: GERRARD 2048.

LONDON, JANUARY 13, 1916.

First 1,200-Volt Railway in England.

Nearly fourteen years ago there was published in these pages a description of the electrification of the Liverpool and Southport line of the Lancashire and Yorkshire Railway, the completion of which made the year 1904 memorable in the annals of British railways. That undertaking was the first example of the application of electric traction to high speed railway passenger train service in the United Kingdom, and from the commencement of the electric service it proved so successful that the railway company were led subsequently to make various extensions. In this issue, by the courtesy of Mr. Aspinall, general manager of the Lancashire and Yorkshire Railway, we are enabled to present a detailed and fully-illustrated account of the latest enterprise of the Lancashire and Yorkshire Railway. This consists of the equipment on the 1,200-volt direct-current system of the line from Manchester to Bury. With the exception of a short experimental line, this is the first railway in the United Kingdom to be worked by direct current at a higher pressure than 600 volts, and it is consequently of exceptional interest. Moreover, the 1,200-volt tension used is probably as high as would be allowed in this country on a third rail conductor. If recourse is made to higher pressure it will be necessary to use overhead wire conductors such as the London, Brighton and South Coast Railway and the Midland Railway employ at Heysham. As it is, the third rail conductor, which has been specially designed by Mr. Aspinall, is so protected by wood as to render accidents to railway servants practically impossible. While there is nothing specially novel in the general arrangements of the Manchester-Bury section, the details have been admirably worked out. In the new power station energy is produced by two three-phase turbo-alternators at a pressure of 6,600 volts, and it is transmitted to sub-stations where, by means of transformers and converters, it is changed to direct current at 1,200 volts, and thence sent out to the conductor rails. The novelty begins with the rotary converters, which produce current at double the pressure ordinarily used for electric railways. Doubling the pressure permits fewer sub-stations, and effects a saving in copper in the low-tension feeders. The train motors are specially designed for 1,200-volt current. There can be no doubt that the great advantages, which have recently been demonstrated in the United States, of the high-tension direct-current system will be speedily realised on the Manchester-Bury line. It is interesting to note that Messrs. Dick, Kerr and Company, who were the principal contractors for the equipment of the Liverpool to Southport section, have been closely associated with the latest electrical enterprise of the Lancashire and Yorkshire Railway. The experimental 3,500-volt line, with overhead conductors, on the Bury to Holcombe section, was designed and constructed by this firm, and on the Manchester to Bury section Messrs. Dick, Kerr and Company have been responsible for much of the plant, especially that required for the high-tension direct current, including the train control system. It should be observed that as the 5-car train used has three motor cars, and each of the latter has four 200-horse-power motors, the total power per train is no less than 2,400 horse-power. This corresponds very closely with the power supplied for the electric trains on the London and South Western and the London and North Western Railways, considering the number of cars forming a train unit in each case. Finally, it may be mentioned that the new rolling stock has been

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manufactured entirely of steel and aluminium, no wood entering into the construction. This is, we believe, the first example of the use in this country of all-metal cars for main line railways.

Difficulties of the Past Year. The main difficulties of the past year in connection with tramway administration have been associated with labour problems, though not in the sense usually attached to that term. With a few exceptions —one of them notable, however—tramway undertakings have since the war began been free from the evils of strikes. The difficulty that has confronted them, and still confronts them in growing measure, has been the maintenance of a sufficient supply of labour. In common with the other industries of the country, staffs have been seriously depleted by the large numbers of men enlisting in the Army. On the one hand it has been impossible in some cases to maintain the usual car services owing to the scarcity of drivers and conductors ; on the other hand, skilled men have been called away from the repair shops to such an extent that it has been practically impossible to carry on satisfactorily the absolutely necessary work of maintenance and repairs. On the other side of the balance has been found a great increase in tramway traffic. Instead of the business falling away, the number of passengers has gone up enormously. In addition to the increase in the ordinary passenger business, special demands have arisen for the conveyance to and from their work of huge and ever-growing numbers of people employed in munition factories. This part at least of tramway work must be regarded as of national importance, because without the tramway services the production of munitions of war would be seriously hindered. In the face of all these things, hearty congratulations are due to tramway managers, committees, and directors on the success with which they have grappled with the situation. The work that has been done by the tramways of the United Kingdom during the past year is a matter not only for satisfaction but for pride to all concerned. The big innovation has, of course, been the introduction of women as car conductors and cleaners. On the whole they are performing their duties well, and they have enabled services to be continued which otherwise would have been curtailed. The representations made to the Government against the further depletion of repair shop staffs have at last been successful, for on the 4th inst. in the House of Commons an amendment was inserted in the Munitions of War (Amendment) Bill declaring that the supply of tramway facilities, when certified by the Minister, is munitions work. This ought to prevent many difficulties, and may be regarded as a triumph for the tramway authorities. We repeat our congratulations to them. Short of men, short therefore of cars, hampered by the darkened streets, pressed by the demand of ever-increasing numbers of passengers, managers have done wonders. And they will continue. The tramways are not merely serving their local public ; they are serving the nation.

The Problem of the Future. Anyone who has had dealings with trade unions will be only too well acquainted with their characteristic reply to the statement that a certain concession must, if granted, turn a profitable business into a losing one. " You can pass it on to the consumer " is the recognised method of outflanking the difficulty. But even in ordinary trade it is not always possible to make the buyer pay for an increase in the cost of production. The consumer may be able to procure a substitute, imported or otherwise ; or he may go without. In the case of the tramway industry, however, this facile evasion is altogether out of the question. Tramway fares cannot, like the price of bread, be adjusted by minor amounts to correspond with fluctuations in the cost of the service. The only possible means of making such adjustments is by modifying the stages—a method which is attractive in theory alone. An alteration in stages results in a serious disturbance of the service and a good deal of irritation among the travelling public. Moreover, regular passengers seem to have got into the habit of spending so much each day on tramway travel ; and when stages are shortened the change is met by walking the extra distance, not by paying an additional fare for the usual journey. Similar results follow when stages are maintained and the fares increased. Many

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tramway managers, in fact, hold that every attempt to increase the cost of travel defeats its own end by reducing the balance on profit and loss account. Their view is that the present standard must be maintained, and that the only way of meeting an increase in working costs is to effect economies in other directions or to find some means of augmenting the traffic. In some cases this policy is dictated by circumstances. Most of the tramway companies in this country are bound by statutory obligations to charge certain fares for certain stages. These obligations are embodied either in Acts of Parliament or in agreements with local authorities. We know of no other industry which is equally bound to sell its commodity—in this case the facility of travel—at a fixed price, while that industry remains susceptible to all the influences that arise in other industries to increase the cost of labour and materials. This is a situation that surely demands the most serious consideration. Tramway managers at present are fully occupied by the problem of securing enough labour, male or female, to maintain their services. They are making the best of war bonuses and inflated prices of materials, in the hope that these disabilities will be modified after the war is over. While it is possible or even probable that materials will become cheaper when the country reverts to its normal business, there is little chance that wages will be allowed to fall. The tramway industry must be prepared to face a permanent increase in its costs of operation. Many of the larger municipal undertakings may be in a position to face this increase, but there are others which, like the majority of tramway companies, are working on so narrow a margin that they will not be able to show a profit. One is reluctant to admit that there is no remedy for such a prospect. The tramway companies, at any rate, have a clear case for the mitigation of many of the special burdens placed upon them by agreements made with local authorities in happier days. Parliamentary authority will be needed to bring about the change; and it might be obtained as the result of strong united effort. There is no valid reason why these old agreements should be treated as sacro sanct; and it would be a simple enough measure to bring them up before a body like the Light Railway Commission (at present out of work) for revision in the light of present and prospective conditions. In any case, if the tramway industry does not urge its claims, and urge them vigorously, it will have no cause for complaint if these claims are ignored.

TRAMWAYMEN DECLARED MUNITION WORKERS.

An amendment of much importance to tramway undertakings was, on January 4 in the House of Commons, inserted in the Munitions of War (Amendment) Bill, which was being considered on report. Clause 7 extends the definition of munitions work as contained in the original Act, and sets out various classes of work that are declared to be munition work. Before the Christmas recess the late Sir George Scott Robertson had given notice of an amendment to include in the extended definition "the supply of tramway facilities." In the interval the honourable Member died. On the amendment being reached, on January 4, Mr. Lloyd George, Minister of Munitions, moved the amendment himself, and it was at once agreed to.

Paragraph (c) of the extended definition of munitions work therefore now reads as follows:—"The supply of light, water, or power, or the supply of tramways facilities in cases where the Minister of Munitions certifies that such supply is of importance for the purpose of carrying on munitions work, and the erection of buildings, machinery, and plant required for such supply."

In response to an appeal by Mr. Harris, the Minister of Munitions promised to consider whether he could include omnibus facilities in the amendment.

EXCESS PASSENGERS AT LIVERPOOL.

At Liverpool, which was the first provincial city in Great Britain to obtain powers from the Board of Trade to permit excess passengers to stand in the lower saloon, the tramways department has always utilised the privilege in the rush hours. Nine is the limit at present allowed, and this number, added to 64, the seating capacity of Liverpool's standard cars, makes a maximum of 73, which, in the opinion of the general manager, is as many as one conductor is capable of handling.

THE LIABILITY TO PRODUCE TICKETS.

Another Useful Decision.

Bath Electric Tramways Company on December 30 summoned a lady passenger for refusing to give up her ticket when required to do so by an inspector, or alternatively to pay the fare.

Mr. W. F. Long, the company's solicitor, said the defendant told the inspector that she was nearly at the end of her journey and had thrown the ticket away. She appealed to the conductor, who said she had paid. From the point of view of the company that was not sufficient. The by-law stated that a passenger should on demand produce his or her ticket or, as an alternative, pay the fare. There had been a case on the same point decided in the High Court. Where a person lost his or her ticket and paid over again, the company were willing to refund the extra money. Defendant had since apologised, and paid the expenses. The company, therefore, asked for the dismissal of the summons, being satisfied with the apology and the attention drawn to the by-law.

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GOVAN DEPOT OF GLASGOW CORPORATION TRAMWAYS.

The new car shed that has been erected on the south side of the Clyde for the Glasgow Corporation Tramways and was opened early in September, takes the place of an old horse-car shed which in 1901 was converted for the accommodation of electric cars. This old shed, however, had become much too small for the requirements of the growing traffic. An eminently suitable plot of ground for the new premises was, fortunately, available in the neighbourhood of the old shed, so that there was no inconvenience caused to the traffic arrangements or to the staff working in that district. The ground purchased for the new shed extends to 18,270 square yards, including streets. The net ground covered by the buildings and courtyard measures 9,416 square yards. The price paid was fourteen shillings per square yard.

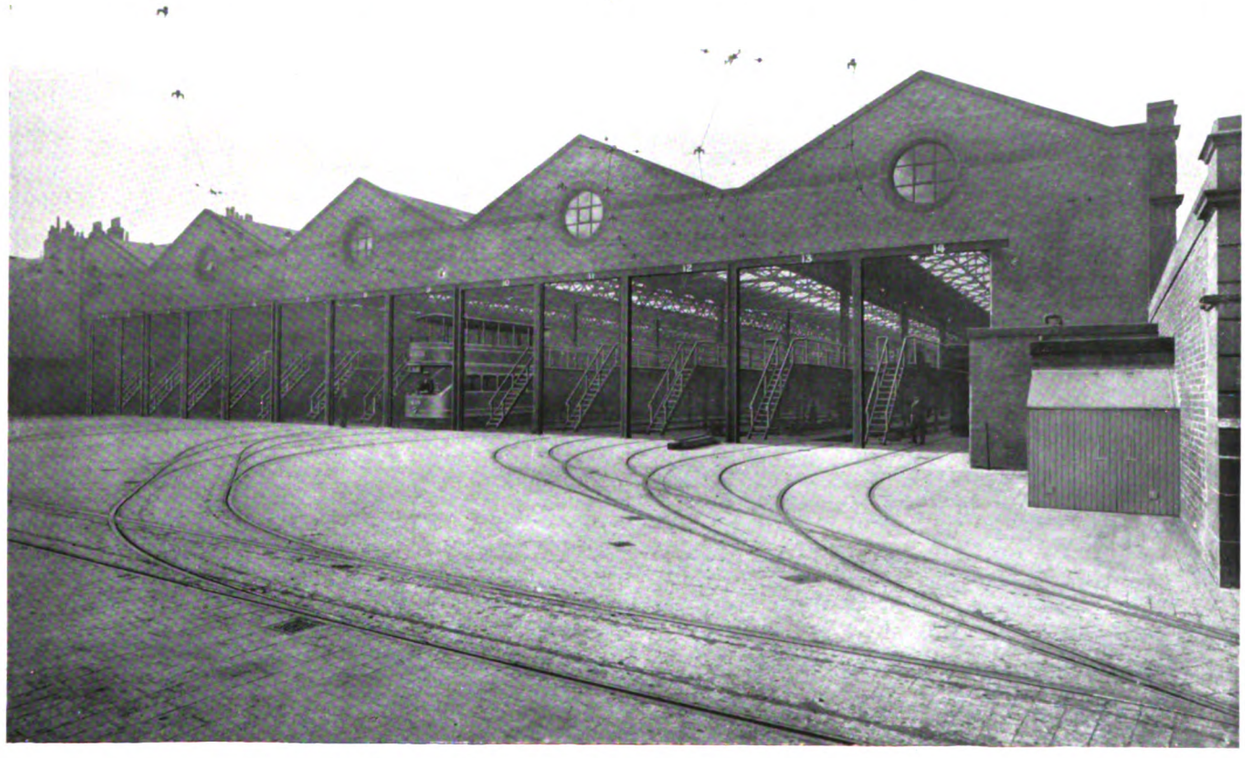
View of Govan Depot from the street.

View of Offices from the yard.

In designing the buildings, considerable attention was paid to the offices, stores, workshop, kitchen, and other accommodation for the staff. On the ground floor of the administrative block there is, first of all, the general office measuring 35 ft. by 38 ft. 6 in.; next comes the entrance hall for the upper floor, also cloak-room, etc. The men's billiard-room has accommodation for two tables, and measures 37 ft. by 26 ft. It may be stated that at all the depots the men provide themselves with billiard tables, the Corporation simply providing the premises.

The kitchen measures 35 ft. by 24 ft. In this room there is a hot-plate heated by gas, also two hot-water kettles, for the use of the night staff. Lavatory and water-closet accommodation is large, and is of ample dimensions for the whole staff. There are also two bath-rooms for the men's use. The whole of the walls are of white enamelled brick.

The fitters' shop and foreman's store measures 34 ft. by 35 ft., and at the end of the block is the



Car Shed at Govan Depot—Glasgow Corporation Tramways.

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cleaners' store, each man having a separate locker made of sheet-iron, with expanded metal door.

It was necessary to make the administrative block of two storeys, on account of the elevation to Harvey Street. On the upper floor is the recreation-room for the staff, which includes a concert hall, capable of accommodating 400 people, with all the necessary ante-rooms.

Depot Office.

The car shed proper has accommodation for about 140 cars. It has an open steel roof, the main couples having 10 ft. centres carried on a lattice girder which runs the whole length of the car shed. The cleaners' gangways are carried on cast-iron columns which are set in a concrete floor. Between the car shed and the administrative block there is an open court measuring 80 ft. by 190 ft. The total cost of the car shed, including ground, amounts to £46,000.

For the description of the new depot and the accompanying photographs we are indebted to Mr. J. Dalrymple, general manager of Glasgow Corporation Tramways.

MELBOURNE RAILWAYS ELECTRIFICATION.

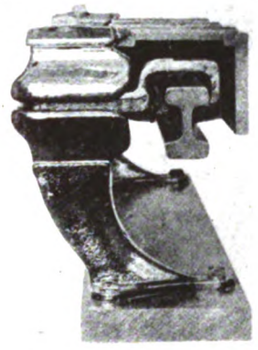
Arrangements for Training the Operating Staff.

The Victorian Railway Commissioners have made the following appointments in connection with the installation of automatic signalling on the suburban railways now in course of electrification. Mr. G. H. Wion, Pennsylvania Railroad Company, assistant signal engineer for five years from July, 1914; Mr. C. W. Prescott, London Underground Railways, transferred to the service of the Commissioners for three years from February, 1915; Mr. T. Kittredge, from the United States, track circuit designer draughtsman, for three years; Mr. W. J. Huggins, assistant inspector of signals and telegraphs, Metropolitan Railway, signal foreman and instructor of fitters, for five years from December, 1914.

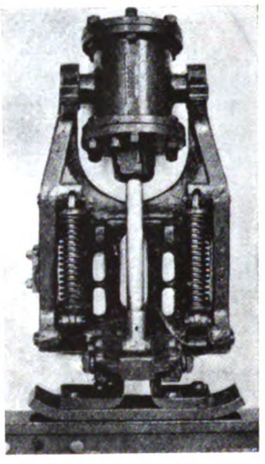
Mr. J. Rist, Central London Railway, has been engaged for training motormen, guards, and other employees. The school of instruction is at the Flinders Street Station, Melbourne, and the actual driving lessons were to be given on the Flemington racecourse line as soon as power was forthcoming from the Newport generating station. The guards and shunting staff, as well as the motormen, are being trained in the work of driving. Thus a guard will be able to take charge of a train in case of an emergency. The adoption of electric traction will bring about a great diminution in the amount of shunting, and the work of the shunters will be comparatively light. Neither the guards nor the shunters will undergo so extensive a course of technical study as the motormen, whose training will enable them to remedy defects that may develop during running. The chief mechanical engineer is to have the direction of the motormen, and the general superintendent of transportation is to retain the control of the guards.

CONDUCTORS AND COLLECTORS FOR ELECTRIC RAILWAYS.

Mr. C. J. Hixson, in a paper read before the American Association of Railway Electrical Engineers on contact conductors and collectors for electric railways, gave a general classification of the different types of device for collecting current from third and fourth rails. In describing some tests made about a year ago Mr. Hixson says that it was found desirable in connection with the use of 2,400 volts for an over-running type of third rail some times to increase the horizontal distance



Third Rail Protection for High Voltage.



Contact Shoe Operated by Compressed Air.

of the third rail from the contact rail by, approximately, 4 in. The third rail shoe used for current of this comparatively high voltage is of a special design, and the slipper with its supporting arm is raised and lowered by compressed air, as shown in accompanying illustration. The contact arm can be raised up against the side of the car so as not to project and be a source of danger. When this is done, the energy is supplied through a slider pantograph.

LIVERPOOL OVERHEAD RAILWAY.

A paper on the history of the Liverpool Overhead Railway was submitted to the Liverpool Engineering Society on December 7 by Mr. E. J. Neachell, the general manager and engineer. Mr. Neachell stated that there are 200 trains in each direction, giving an average headway of 5¾ min., but during the times of heaviest traffic (6.30 to 7.30 a.m. and between 5 and 6 p.m.) the interval between trains is only 3 min. In the evenings and on Sundays a 10 min. service is in operation. During the past five years the average number of train-miles run was 845,765. During 1913, the last complete year before war broke out, when the shipping trade of Liverpool was probably better than it ever had been, the average number of workmen's daily return tickets was 6,700, equivalent to 13,400 passengers —or a total of nearly 4¼ millions in the year. As the dock estate develops northwards, and the larger steamers are transferred to the docks now in course of construction at the Seaforth end, these numbers should not only be maintained but largely increased, and thereby tend to the expansion of the other classes of traffic.

Non-Inflammable Railway Carriages.—In answer to a question in the House of Commons relating to deaths caused by carriages catching fire in a recent railway accident, the President of the Board of Trade stated that some of the principal railway companies were understood to be carrying out the recommendation that coaches should be constructed of steel as far as possible, and that any timber used should be rendered non-inflammable. On the Underground electric railways, on which the rolling stock must be of a type approved by the Board of Trade, the woodwork of the cars had to be non-inflammable. The Board of Trade had no power as regarded ordinary railways to make an order declaring it obligatory that all new railway carriages shall be of non-inflammable material.

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DEVONPORT TRAMWAYS ARBITRATION.

Mr. B Hall Blyth, sitting at the Surveyors' Institution, Westminster, on December 17, resumed the arbitration relative to the purchase of the Devonport and District Tramways by Plymouth.

Mr. J. W. Sparkes, electrical engineer to West Hartlepool Council, and formerly to Devonport Corporation, had given evidence in support of the Council's case at the last sitting on November 23. He was cross-examined by Mr. Macmillan, K.C., concerning his statement that if the company continued in existence they might expect to have to pay an increased charge for electricity. He now said that the price had been considered on three separate occasions. It was dealt with twice by the Board of Trade and once by a round-table conference. There had been reductions made in the price in each case. The first adjustment fixed the average price at 1·8d. per unit, the second in 1906 fixed it at 1·7d., and in 1911 the amount was reduced to 1·39d. per unit by agreement.

Mr. R. J. Fittall, formerly town clerk of Devonport, and now consulting town clerk for Plymouth, said the company approached Devonport Council in 1906 and 1911 as to through running with Plymouth. In 1912 terms were provisionally arranged, but nothing was done to carry them into effect. As the result of the recent amalgamation of Devonport with Plymouth, he was convinced that the present Council would not have consented to through running with the company. He had formed that opinion by attending meetings of the Tramways Committee.

In cross-examination, witness recalled the rail-motor competition with the tramways. The former was a much quicker service between definite points. The company's period of prosperity had been since the time of that competition in 1905. He agreed that the Devonport Corporation could have enabled the company and Plymouth Corporation to have made arrangements for through running. The terms upon which Devonport would give their consent under the Light Railway Order had been practically concluded, but had not been submitted to Plymouth.

Mr. J. R. Waller, consulting engineer, stated that in making a valuation of the tramways for the Corporation he took the prices ruling at such a period anterior to the date of transfer as would enable the construction and equipment to be carried out by the time of the transfer. He had based the price on figures ruling some 15 months anterior to the date of tranfser. He had taken the agreed figure of £12,000 as being the present value of the cars, which he estimated had an average life of 11·7 years. The gross profits from October 2, 1915, to August 12, 1919, he put at £15,514, and the net profits at £11,703. He looked for an increase of one-third in the number of passengers in the event of through running.

Cross-examined, witness admitted that he would not be able to get a tramway constructed just now. Asked why a good price should not be given for a tramway ready made at this period of the war, witness said that when counsel fixed a good price he saw no reason why he should stop at the figure he claimed. The reason why witness had made deductions in respect of extra expenses on cables on the leased lines was that they were not well maintained. The owned lines were well kept up. He contended that his figures of 33½ per cent. increase, which he had allowed for through running, was a very large allowance.

The proceedings terminated on December 20, when counsel made their final speeches. Before they did so the arbitrator said:

"As this is a somewhat complicated case, and as I am anxious that there should be no misunderstanding as to whether or not I have applied my mind to all the points referred to me, I have asked my assessor at this stage to put my award into form, leaving the figures blank. He will to-day hand to the solicitors the draft, which they and counsel will please read over and make any suggestions. After I have given careful consideration to the evidence and the speeches of counsel, I shall fill in the figures. There are one or two points which I shall specially mention just now:—

"1. Counsel for both parties have referred to what they call 'a technical ragged edge.' That is in connection with certain powers under the Light Railway Order. In the draft form of award I merely, when dealing with the light railway, quote the words of the agreement under which I was appointed arbitrator. It may be that parties may wish to add some further words to the draft to show exactly what is the counterpart of the price which I shall fix as the value of the light railway. I am in entire agreement with learned counsel that there should be no 'ragged edge' left about this matter.

"2. I wish to make it clear that I have fully in view what Mr. Lloyd said regarding the point about war prices. If after consideration I come to the conclusion that I am bound to accept prices quoted under the circumstances dealt with by Mr. Lloyd in his opening speech, and those alone, then I shall find figures and state my award in the form of a special case in order that the opinion of the Court may be taken.

"3. Finally, regarding costs, I suppose the parties are agreed that I am to have full power and jurisdiction to deal with the whole costs as I think fit. In the draft award which is to be handed to the solicitors I have not dealt with costs for the reason that I shall come to no conclusion regarding them until I have the benefit of the views of counsel as to how they shall be disposed of."

IMPORTANT LAW DECISION.

The action of Kitson and Wife v. the Yorkshire (Woollen District) Electric Tramways, Limited—a case somewhat unusual in its facts and of interest as giving a reminder that there is a line beyond which plaintiffs cannot successfully go in alleging negligence against tramway or omnibus proprietors—came before Mr. Justice Atkin and a special jury on December 2 at Leeds Assizes. The claim was in respect of personal injuries sustained by the wife while alighting from a car. The facts proved or admitted were as follow: On Saturday, November 8, 1913, Mrs. Kitson (who was 58 years of age) and her daughter were travelling in a single-decked car in Dewsbury. On arriving at their destination the daughter got off, and then Mrs. Kitson attempted to alight. Being stout, she turned to face the rear window of the car to get off sideways. She put her left hand on the support rail below the window, and her right hand on the top guard bar across the window. The window bar gave way, and she fell into the street, the bar coming away in her hand. She was considerably injured. She admitted that she had been on these cars scores of times, but said it was not obvious to her that the bar was there to guard the window and passengers near it from injury. She had never been warned nor seen any notice not to use it. She alleged she had seen hundreds use it in the same way. There were three rods across the window; below them a grabrail (3 ft. 2 in. from the level of the platform); and the usual upright stanchion at the opposite side of the entrance to assist passengers while mounting or leaving the car, the distance between the grab-rail and stanchion being 2 ft. 2 in. Defendants' counsel submitted that there was no case to go to the jury. The Judge held that there was no evidence of negligence to go to the jury. It appeared quite plain to him that the bars were not provided for the purpose of enabling passengers to use them in passing out of the car, and there certainly was no evidence that the means that were provided, namely, the grabrail and the stanchion, were not adequate for use on mounting and leaving the car. There was no evidence that the car was not provided with reasonably safe means of exit. Plaintiffs said that the company ought to have known that passengers would use these bars, and would throw their weight upon them, and that therefore they ought to so fix the bars that, however heavily a passenger put his weight upon them in ascending or descending, they would not give way. He could not see that there was any evidence that the company might reasonably expect passengers to put their weight upon the bars, nor did he think there was any obligation to accept that as a reasonable use of the car; nor could he agree that in fact they so arranged this car as to constitute a trap. He could not see any evidence of negligence in not so fixing the top bar that it would hold the weight plaintiff put upon it, and he could not see any breach of duty on defendants' part. The case therefore could not go to the jury, and there would be judgment for defendants, with costs. Counsel for plaintiffs were Mr. A. W. Bairstow, K.C., and Mr. R. A. Shepherd, instructed by Mr. C. S. Hays, Heckmondwike; and for defendants Mr. W. J. Waugh, K.C., and Mr. Richard J. Sutcliffe, instructed by Messrs. Dwyer and Son, Dewsbury.

PRIVATE BILLS FOR 1916.

Private Bills to be considered in the forthcoming session show a great falling off in the number deposited, owing to the Treasury restrictions on the spending of money by local authorities. The plans deposited number only 15, as against 158 last year. Railways number 1, against 4 last year; tramways 1 against 10; miscellaneous 5, against 35; provisional orders 9, against 109.

The one tramways Bill is presented by the Metropolitan Electric Tramways Company, who are applying for extension of time for completion of tramway No. 5 authorised by Metropolitan Electric Tramways Act, 1911, and of trolley vehicle equipment authorised by Metropolitan Electric Tramways (Railless Traction) Act, 1913, for purchase of lands under Metropolitan Electric Tramways Act, 1905, for exercise of powers of the Middlesex County Council as to purchase of parts of the undertaking and powers of the company, and for execution of street widenings in Tottenham Urban District; relief for Middlesex County Council in respect of notices to treat for purchase of lands under the Act of 1911.

LIGHT RAILWAYS ACTS, 1896 AND 1912.—ORDERS CONFIRMED.

West Sussex Light Railway Order, 1915, authorising the construction of light railways from Hunston to West Itchenor, West Wittering, and East Wittering, including the reconstruction and working as a light railway of the Selsey Tramway.

Authorising the construction by the Joint Boards of the Urban Councils of Wombwell, Wath, Bolton, and Thurnscoe of light railways from Barnsley to Thurnscoe by way of Stairfoot, Wombwell, Brampton, Wath, and Bolton, with a line to link up with the Mexbro'-to-Rotherham system from Wath. This scheme carries the railways to Bolton by way of Staithes Crossing, Manvers Main, but an amended application will be made to abandon that route and to go to Bolton direct by the road passing the three railway stations.

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THERMIT RAIL WELDING PATENTS.

Question of Granting a Licence.

At the Patents Office, London, on January 5, the Controller General of Patents and Sir Cornelius N. Dalton heard counsel and evidence in an application by the British Thermit Company, Limited, Liverpool, for Orders of the Board of Trade avoiding or suspending certain letters patent connected with welding rail joints. The application was opposed by Thermit Limited, London. Mr. E. R. Royston, patents agent, Liverpool, appeared for the applicants, and Mr. H. A. Colefax, K.C., and Mr. J. Hunter Gray for the opponents.

Case for the Applicants.

Mr. Royston said that the application was for the avoidance or suspension of eight patents which had reference mainly to the welding of tramway and other rails. The applicants practically consisted of two people, Mr. Blackwell and Mr. Turner, who were applicants in a prior case early last year under which two earlier patents were suspended. Thereafter they formed themselves into a company, which was practically owned by Mr. Blackwell. The company then started to sell thermit, the process in which thermit was used being the subject of the two patents. Thermit itself was open for use by anybody, and the two patents were directed to the use of the material for joining the ends of rails and for similar purposes. One of the chief reasons for the present application was that it was considered by some that the patents now in question were used by Corporations in alumino-thermic joining of the ends of the rails. Corporations had told the applicants that the Thermit Company stated that the thing could not be done without these patents.

Mr. Colefax, representing Thermit, Limited, objected to this statement.

Mr. Royston contended, however, that the applicants were under a disability, and they claimed at least to be put into as favourable a position for carrying out the process as the opponent company, who were keen competitors and were doing all they could to keep hold of this business.

The Controller General asked if the applicants wanted a licence for the patents.

Mr. Royston.—Yes.

The Controller General said that the difficulty which remained was that some of these patents were for improvements in the process and some were for actual apparatus.

Mr. Royston said that if the applicants used any of the patents they would pay the royalty. The simple way would be that every time any of the patents were used in the joining of rail ends, the royalty should be payable at so much per joint. The royalty should be very small, as Thermit, Limited, had a dominating position.

The Controller General said that it was another instance of what he saw every day, namely, that although English manufacturers might have had everything in their hands in 1901 he left everything alone, and left a German company to take out a patent every year to develop the process. Then after 15 years the English manufacturer came and said what a dreadful thing it was. Of course it was. It was the same thing that had happened with company after company in the most important industries in this country. But it was no use blaming the German company. They were not fools when they saw the probabilities; the English companies were.

Mr. Royston, in further argument, suggested that the royalty should be 6d. per joint. Proper accounts should be kept to show to what extent the patents were used.

An Opponent's Point.

Mr. Colefax (for Thermit, Limited) contended that the Controller General had to be satisfied about certain things under the Patents (Temporary Rules) Act, 1914, and he had not heard a word from the other side to satisfy the Controller. One of the rules was that the Controller should be satisfied that the applicant intended to manufacture the patented article or to carry out the patented process. Another was that it was in the general interest of the country or of a section of the community, or of a trade (which did not mean an individual company) that the article should be manufactured or the process carried on. That had no application here. The company that owned these patents was at present carrying on the business under a controller appointed by the Court, and was doing everything that was required in the country. More than that, it was a controlled establishment under the Munitions Act.

The Controller General said that the legislation referred to was passed in order to foster English trade, and to set up side by side with German interests in this country purely English undertakings.

Mr. Colefax said that according to that anybody could come and say, "Here are some patents owned by an English company, the shareholders of which are Germans. I would like to start in this business; please avoid these patents or give me a licence under them."

The Controller General said that he would start with a predisposition in the applicants' favour.

In previous cases of important industries he had always taken the view that even if a German-owned company could carry on the business, it was his duty to recommend the setting up of a purely English venture.

Mr. Colefax maintained that that was not the true interpretation of the rule.

Mr. W. L. Turner, one of the applicants, was then called, and gave evidence bearing out Mr. Royston's statement as to the difficulties with which his company had been met owing to the patents. His company had not yet got an actual staff together for carrying out the welding of rails. They were waiting till they got the patents.

Experimental Work.

Cross-examined by Mr. Colefax, the witness said that his company had not attempted to weld any tramway rails, but they had carried out certain experimental work. They had not tried to get Corporations to employ them to weld rails, but they had sold thermit to Leeds and other Corporations.

Mr. Colefax asked a number of questions as to the Corporations who had refused to buy the applicants' thermit on the ground that the existing patents prevented the Corporations from carrying out welding, and pointed out that very few Corporations did such work. The rule was that it was carried out by the workmen of Thermit, Limited.

Witness replied that his company wanted to get the Corporations to do their own welding.

The Controller General remarked that he had a desire to see the trade freed. Thermit, Limited, were, however, perfectly entitled to say that the present applicants were not the right people.

Mr. Colefax said that the proper course was that any Corporation who wished to do the welding should apply for the suspension of the patents. As a matter of fact, the Corporations did not wish to do the welding. There was no question but that Thermit, Limited, could make thermit far better than anybody else.

In further cross-examination, the witness was pressed to say why he wanted certain of the patents, seeing that they were not necessary for making welds, but he maintained that they might be desirable for the purpose.

Evidence for the Opponents.

Evidence for Thermit, Limited, was then heard.

Mr. Arthur Taylor said that his firm, Hudson, Smith, Briggs, Smith, and Taylor, chartered accountants, were in October, 1914, appointed by the Board of Trade under the Trading with the Enemy Acts to inspect the books of Thermit, Limited, and investigate that company's affairs. He received every assistance from the officials of the company, especially from Mr. Stutz, the managing director. He found that at the first meeting of the directors after the incorporation of the company in 1904, Mr. Stutz was appointed a committee of one to exercise all the powers of the directors, and those powers he still exercised. Government Departments had been customers of the company. On January 22, 1915, witness was appointed by the Court controller to supervise the conduct of the company's business. That business had been properly and thoroughly managed. After the war began the company set up additional plant. All the materials employed in the manufacture of metal substances and the machinery were wholly British. All the staff were British. About 80 per cent. of the company's output at present had relation to munitions of war. The company had a high reputation for quality.

Mr. J. B. Hamilton, general manager of Leeds City Tramways, said that in Leeds they had employed thermit in the construction and maintenance of their lines for nearly 13 years. He believed Leeds was the first town in Britain to take it up. The Corporation's workmen did the welding. A very considerable amount of skill was required on the part of the operators. The Corporation only employed for the work, men of long experience and training. In response to a circular from the applicants in the present case, the Corporation bought some British thermit. Three welding operations were carried out with it and they produced very bad joints. One went to pieces before it could be tested properly. With the second, they got deflections of one-sixteenth at 25 and 30 tons' pressure with supports 3 ft. apart. With the third, they got deflections of one-sixteenth at 10 tons, and it broke at 15 tons. The thermit joint, in his department's view, was not satisfactory unless it stood a pressure of 80 or 90 tons. Thus for tramway welding the British company's thermit was no use at all. A number of other Corporations had tried to carry out welding themselves, but probably because they had not the trained experience they had adopted the method of getting the whole operation done by Thermit, Limited. Leeds Corporation used some of the patents to which the present application related. The payments to Thermit, Limited, included the right to apply any of the patents if the Corporation chose to hire the appliances.

Argument of the case was resumed.

Question Confined to Licence.

Mr. Colefax said that he wished to know which course was being pressed by the applicants—avoidance of the patents, or the granting of a licence. He submitted that no case had been made for avoidance.

The Controller General said that Mr. Colefax might take it that unless Mr. Royston made out a case for avoidance, as distinguished from suspension and an ordinary licence, the tribunal would not deal at all in their report with the question of avoidance.

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Mr. ROYSTON.—I shall not ask you to do that.

Mr. COLEFAX then proceeded to contend that there was no case for a licence. The royalty suggested of 6d. per joint was absurd, as 5 per cent. on the cost was the lowest figure at which a licence had been granted. On a cost of 40s. for thermit and labour foreshadowed by Mr. Turner, 2s. 6d. would be a fair royalty. But he maintained that a licence ought not to be granted unless of a case being made out for the need to use any of the patents. There was no evidence from which the inference could be drawn that there was any substantial chance of the applicants doing this welding. Then the applicants could not tell which of the patents they thought they would need to use. The patents were for special things, not for improvements on old processes. He maintained that the tribunal could not be satisfied on the points under the rules. The applicants roped in all the patents relevant to welding, and asked for a licence under any one of them. Surely that was not the intention of this legislation. Let the applicants embark in welding and see what they could do, and if they found that there was a patent here and a patent there for which they wanted to apply, then would be the proper moment for them to come forward. At present he would have thought the proper applicant for a licence would be a Corporation.

THE CONTROLLER GENERAL.—I wish they would come.

Mr. COLEFAX contended that it was not the intention of this legislation that a promiscuous and general licence should be given. Thermit, Limited, did not themselves use all the patents for tramway rail-welding. The applicants had done nothing to start the rail-welding business. All they had done in the course of a whole year was to bring some thermit a little nearer to some iron rails and to say they were about to begin on experiments. They could not show any ground for saying that any one of the patents was required. He asked the tribunal to refuse a licence, but if a licence was granted there should be a proper royalty.

THE CONSTRUCTION OF THE RULES.

Mr. J. HUNTER GRAY followed, also on behalf of Thermit, Limited. He said he wished to deal with the construction of the rules. An applicant for a licence must be both meritorious and competent. If a patentee was carrying out the business of his patent thoroughly and efficiently, and to the satisfaction of the public in this country, to give a licence to someone who would do the work badly would not only not encourage British industry in this country but would discourage it, because if an incompetent competition was allowed it would discredit the value of the processes in the mind of the public, and after the war the public would go back to the Germans again. No single fact had been presented which would justify the giving of any of the patent rights to the applicants. If the present was the sort of applicant to whom a licence should be granted, then heaven help the British industry. Such grants would discredit the abilities of the true British workman. No witness had been called from any Corporation to bear out that statement that any of these bodies would not buy the applicants' thermit because of the patents. Whatever work the applicants did would be done without proper investigation and would be ineffective work, with the result that the process would be discredited very largely in this country. The opponent company was managed by a gentleman who was a British subject, who had been for many years in this country and who carried on the business in the most effective and proper way in the interests of this country. In construing the rules, could it be thought, if the opponents were for any reason stopped from working in this country, that persons like Mr. Turner would fill the gap? There were alternative processes of electric welding which would be adopted instead, and the result would be the destruction of the thermit process in this country. Mr. Gray proceeded to point out that the reason why the Corporations did not apply for licences to work the patents obviously was that they were satisfied with the position. Mr. McElroy, the general manager of the Corporation tramways at Manchester, in the proceedings of the Municipal Tramway Association, 1910-11, had said, "I want to give a word of warning, because so much depends on how the thermit welding is done. In the earlier days when we allowed the ordinary platelayers to do the work the thing was doomed to failure. They did not recognise that it was a scientific job. Now we employ welders supplied by the Thermit Company themselves, and these men get bonuses for correct work. Our three years' experience of thermit welding has led me up to the present time not to consider any other form of joint."

The CONTROLLER GENERAL said a question was whether the manufacturers of this country should not be trained to do the work instead of going on idly and supinely, and whether without a licence they could be given the opportunity.

Mr. GRAY hoped that the Controller would not allow that important consideration, which was far broader than anything dealt with by the Act, to shut his eyes to the fact that by granting a licence he would be defeating his object. By the applicants' inactivity during the past year he should be treated as a naughty child, and told to go away and come back again when he was good, and should then put the tribunal in possession of facts and not prophecies of a most ridiculous kind.

REPLY FOR THE APPLICANTS.

Mr. ROYSTON, replying to the opponents' arguments, said that as regarded the applicants' competence, when they were making alloys by the alumino-thermic process, their works were inspected by Government inspectors, and they were selected as one of the only seven firms selected in this country for the making of such alloys. Was it likely that the Government would choose the applicants if they were incompetent users of the thermit process? The thermit supplied to Corporations was satisfactory. As to the Leeds case, it was quite possible that anybody in turning out the stuff might make bad samples. It was an isolated case, and Leeds had made no complaint to the applicants. They were people of exceptional ability in the work, and to suggest that they could not carry out another thermit process in connection with rail welding was preposterous.

Mr. ROYSTON, in reply to the Controller General, said that the applicants would do the welding themselves for Corporations. If the Corporations bought the applicants' thermit and did the welding themselves, they would not be protected by the applicants' licence.

Some discussion took place on this point, which was closed by Sir C. Dalton saying that if the Corporations wanted a licence they could come and ask for it.

Mr. ROYSTON, on the question of royalty if a licence was granted to the applicants, contended for 5 per cent. on the cost of applying any of the patents, excluding the cost of the thermit, which anybody was at liberty to make.

Mr. TURNER said he would be agreeable to 1s. per joint.

The CONTROLLER GENERAL closed the proceedings by saying that they might require further evidence. If not, the tribunal could consider the matter and report to the Board of Trade.

AMBULANCES STILL NEEDED.

The life of a motor ambulance on the western front is not more than six weeks or two months. This statement was made by a representative of the British Red Cross Society and the St. John Ambulance Association, speaking at a meeting held at Leeds in support of the cinematograph trade's resolve to provide an ambulance convoy at a cost of £30,000. The information will be of interest in view of the article published in our issue of October 16, urging the provision of ambulances by tramway interests. Up to the beginning of October ambulances and other motor vehicles for use in Great Britain, France, Belgium, Malta, Egypt, the Dardanelles, Serbia, and Italy had been provided to the number of 907 ambulances, 33 cycles, 213 cars, brakes, and omnibuses, 55 lorries, 10 repair shops, and 17 soup kitchens. From September 15, 1914, to September 15, 1915, over £280,000 has been spent on the purchase of cars, and about £170,000 on their upkeep. Since then 250 new cars, costing approximately £110,000, have been placed in commission. A single ambulance now costs £450. In the early months of this branch of Red Cross work Mr. A. F. P. Roger was in charge of the department, and on being called to other duties at the Ministry of Munitions last spring, he was succeeded by Mr. E. M. Clarke. The department provides every requisite and comfort for the wounded upon their journey home from the front. A few days ago the British Red Cross Society appealed not only for ambulances but for money to meet the running expenses, which work out at about £8 a week per ambulance.

The Belgian Field Ambulance Service is appealing for £10,000 wherewith to complete their fleet of ambulances.

Five convoys, comprising 120 cars, have been sent to France to supplement the French Red Cross service by the British Ambulance Committee of the Service de Sante Militaire.

LONDON TRAMWAY SERVICE.

POWER PLANT AND CABLE EXTENSIONS.—DOUBLING SINGLE LINES.

A collection of articles that fall through the aperture of the conduit and divert the power was exhibited to the members of the London County Council on December 21. The exhibits, which were retrieved in one week, included six iron hoops. Each article bore a label mentioning the length of time it had delayed the cars. A reserve supply of power is being sought for the Woolwich services, and £4,200 of a sum of £11,800 voted for the provision and laying of cables is to be used for putting down cables in the district. The County Council have sanctioned an outlay of £5,000 for the construction of foundations and floors for a third turbo-generator, to take the place of a reciprocating engine in Greenwich power-station. During the period of the war ordinary fares are to be charged on cars specially run as all-night cars. Experiments are to be made at certain termini and traffic points for notifying the suspension of existing, or the institution of new, car services. Mr. G. H. Hume, chairman of the Highways Committee, informed the Council on December 21 that in the event of any serious stoppage of the tramway services or underground services telephonic notification is given to the South London Electric Railway, so that everything possible can be done to provide extra facilities on the other undertaking. Four single sections of line between Nile Street, Woolwich, and Abbey Wood are to be doubled. The estimated cost of the work is £4,500. The Minister of Munitions suggested that the whole of the tramway should be doubled, but the committee reported that it was impossible at present to double the line throughout.

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TRAFFIC DANGERS IN LONDON.

Sir Edward Henry, Commissioner of Police, on December 14 issued a statement emphasising the urgent necessity for greater care in the driving of motor vehicles, especially after sunset, in London. Rates of speed that were free from objection in normal circumstances become a source of danger to the public in the dark streets and cannot be permitted. Appeal is made for greater care and for pronounced reduction of speed, both of which are essential to the public safety. The police have instructions to enforce the Motor Car Act with the utmost stringency.

At a meeting of London County Council on December 21, Mr. J. D. Gilbert called attention to the fact that as compared with 1913 in September, October and November this year street accidents had almost trebled, viz., 43 against 15, and asked the Public Control Committee to make representations to the police as to the urgent need for controlling the speed of motor traffic after dark.

Mr. C. U. Fisher (chairman) replied that the police were wholly acquainted with the facts, and no useful object would be attained by making representations. A police notice on the subject was issued during the previous week.

Street Lighting and Accidents.

Mr. Alden, in the House of Commons on December 21 asked the Home Secretary whether he could state the number of accidents, fatal and otherwise, which had taken place in London during the last three months; what proportion of these accidents had been due to the darkening of the streets at night; and whether he would consider the possibility of increasing the illumination in the streets on nights when there was no fear of Zeppelin visits.

Sir John Simon: I am informed by the Commissioner of Police that the number of persons killed in street accidents in the whole of the Metropolitan and City of London Police Districts during the last three months was 263. The number injured, including cases of slight injury, was approximately 7,000. It is impossible to say what proportion of these accidents may have been due in greater or less measure to the darkening of the streets. The number of accidents occurring during daylight is, however, considerably greater than the number occurring after dark. It would not be practicable to vary the lighting of London from night to night.

LEEDS TRAMWAYS OFFICES.

By the opening on December 28 of a portion of the new premises erected for the Tramways and Highways Departments of Leeds Corporation, the tramways undertaking of the city is now able to carry on its work free from the restriction of inadequate space imposed by the old premises in City Square. The new buildings are situated at the junction of Sovereign Street and Lower Briggate and adjoin the central depot. There are four storeys, each connected by separate lifts for passengers and goods. A considerable portion of the basement and the ground floor has been allotted to the traffic department, and a rear entrance has been provided to the office at which tickets are issued to the conductors and their cash is received. On the first floor are the offices of the general manager, Mr. J. B. Hamilton, and the committee-rooms for the Tramways and Highways Departments. The accountant's offices and the drawing office are on the second floor, while the top floor is devoted to rooms containing the ticket receptacles. When completed, about the end of February next, the new premises will have cost about £30,000.

CHANGES AT EDINBURGH.

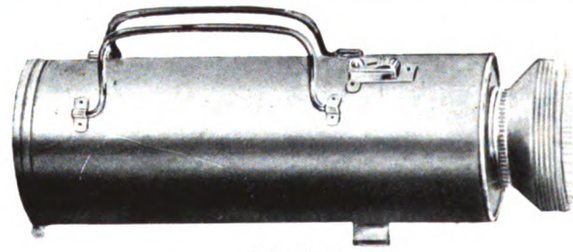
Mr. C. W. Shepherd has resigned the position of general manager and secretary of the Edinburgh and District Tramways Company. The directors have accepted the resignation with regret, and have requested him to retain the position of secretary. In 1913 Mr. Shepherd underwent a severe operation, and has since been in indifferent health. The strain thrown upon him during the war has been so great that he has been reluctantly compelled to resign the position, which he has held for the past nine years. He went to Edinburgh from Bradford thirteen years ago as traffic superintendent, a position he filled for four years.

Mr. J. D. R. Cox, of Messrs. Babcock and Wilcox, Limited, has been appointed general manager and engineer of the Edinburgh and District Tramways Company, in succession to Mr. C. W. Shepherd, and Mr. E. F. Harris, the latter having taken an appointment in London. The salary of the dual position will be £1,200 per annum. Mr. Cox, who is thirty-five years of age, has a reputation for engineering skill and general energy. After serving an apprenticeship to engineering, he was engaged in Glasgow Corporation electricity works, and prior to the war he was assistant commercial manager in Scotland for Messrs. Babcock and Wilcox. Soon after the outbreak of the war he joined the Scots Greys, and later received a commission in the R.F.A. Recently he returned home to act for the London manager of Messrs. Babcock and Wilcox during illness.

A LAMP FOR CONDUCTORS.

The illustration in this column depicts a conductor equipped with a new single cell portable hand lamp to enable him efficiently to discharge the duty of giving change and punching tickets during the period of restricted lighting.

It is known as the "Razzo," and has been introduced by the Equipment and Engineering Company, 2, Norfolk Street, Strand, W.C. For illuminating purposes a 1½-volt bulb is provided in a reflector, and as standard types of dry cell are used, refills can be easily obtained. A single charge gives about fifty hours' light.



The Lamp.

The weight is 39 oz., and the lamp is 2⅞ in. diameter by 9 in. long. It is made in three finishes, namely, pressed steel (black) seamless brass (burnished finish), and seamless brass nickel-plated

PASSING OF STATIONARY TRAMCARS.

A Manchester Request for Legislation.

Manchester Watch Committee have asked the Traffic Congestion Committee of the Corporation to seek Parliamentary powers for dealing with the danger caused to tramcar passengers by vehicles driving through them while they are entering or leaving a car. Attention was drawn to the matter by a member of the Watch Committee at a meeting of that body held on December 9, with the result that the Committee requested the Chief Constable to issue a notice calling attention to the danger attending the practice. Motor drivers are the principal offenders, and the Chief Constable was instructed to prosecute in the case of offences committed after the warning has been given. Ample authority for this course exists in Section I. of the Motor Car Act, which relates to driving to the danger of the public.

London and South Western Railway Electrification.—In the description of this undertaking given in our issue of November 18, we inadvertently omitted to mention that W. T. Henley's Telegraph Works Company, Limited, supplied, through Messrs. Tyler and Freeman, 40, Chancery Lane, London, W.C., a large quantity of single 3-core rubber insulated wire armoured cable of various sizes, including 19/14, 19/15, 19/18, 37/13, 37/15, and 61/13.

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THE WAR AND TRAMWAY TRAFFIC.

Effect of Enlistments and Reduced Lighting.

Combined with the restricted lighting, the increased number of enlistments is making the maintenance of tramway services a matter of considerable difficulty. The outlook is rendered more serious in a number of places on account of the opening of new national munitions factories. A vast number of men and women are being drafted to those districts to work in the factories, with the result that there will be a demand for additions to the workpeople's tramway services. Car facilities for workmen are already abnormal in many towns, owing to munition work being performed in shifts. As more and more unskilled hands are trained, night work in the factories will increase.

Several tramway undertakings have been inconvenienced through inability to prevent workmen engaged in car repairing shops leaving to secure employment elsewhere. Wolverhampton Munitions Tribunal recently considered a complaint by a blacksmith and a blacksmith's striker who were employed solely in repairing cars at the tramway depot. They had secured work on Government contracts, but the manager refused to grant the leaving certificates. In a letter to the Court the employers remarked upon the importance of maintaining an efficient service for the use of munition workers, and the necessity of keeping the remainder of their depleted staff. The Court decided that as the applicants were not engaged on munition work, and that as they did not come within the meaning of the section, no discharge certificate was necessary. The applicants were free to go where they liked.

The position of Birmingham Corporation Tramways may be regarded as typical of traction undertakings in all the centres where war work is in progress. Although there are now nearly 600 women conductors, the department is 20 per cent. below strength. Barely 25 per cent. of the uniformed staff of 1,600 who were employed prior to the war are at work on the cars now. Consequently the service on some of the routes has suffered, and no improvement can be made until the voluntary motormen have been trained. Every spare car that can be manned has to be placed on routes serving munition areas, and more are needed.

A scheme was sanctioned by Newcastle Tramways Committee on December 16 in order to enable the services to be maintained until 10 p.m. on weekday evenings, instead of withdrawing the cars at nine o'clock, as had been done since November 1. Mr. Ernest Hatton, the general manager, had submitted to the employees' representatives a schedule that altered the working hours by the inclusion of more women conductors and volunteers in the running of the cars in the early morning, thus enabling more men to be employed at night. In return for the extra hours worked, the employees are promised a short day once every third week, and a day off every week. Additional men and women are being trained, and Councillor R. Mayne, chairman of the Tramways Committee, has stated that the difficulty was to get volunteers who could train during the day. He has appealed to such men as ministers and insurance agents to come forward and add to the 120 volunteer motormen now working on the cars. While the committee were conscious of the inconvenience caused to some of the community by the curtailed service, the tramways, he has stated, were carrying 50,000 more workmen per week, and in this connection he paid a high tribute to the general manager. It is worthy of note that the Amalgamated Society of Engineers have written to the Corporation expressing approval of the Tramways Committee's action in concentrating upon the workmen's traffic.

Mr. C. J. Spencer, general manager, Bradford Corporation Tramways, has advertised for conductors ineligible for military service, and also for auxiliary car drivers, in order to enable the department to provide against the anticipated difficulty in meeting public demands. The advertisement for auxiliary drivers invited applications from "public-spirited men who are ineligible for military service, and who are willing to undertake to learn drivers' duties, with a view to their employment at week-ends, and during other periods of heavy traffic. Up to December 17 there were 150 applications, and those who passed the medical examination are being trained.

Bournemouth Corporation decided that the last cars should start at 10.30 p.m. between December 13 and January 10, and at 10 p.m. after the latter date. Councillor Bell, chairman of the committee, said they were agreed that it was not advisable to ask men who were tired to take the cars through a black atmosphere for a longer period. The manager had compiled a list of 30 towns where the hours had been curtailed to a much greater extent, and in 12 other towns the committees were bringing up recommendations.

British Electrical Manufacturers and Russia.—The Electrical Manufacturers' Company of Great Britain, Limited, has been registered, with a nominal capital of £12,000, in £1 shares, to carry on business in Russia and elsewhere. The promoters are Messrs. Bruce Peebles and Company, Crompton and Company, the Lancashire Dynamo and Motor Company, Allen West and Company, Brook, Hirst and Company, Eckstein, Heap and Company, and Whipp and Bourne. The first directors are Messrs. J. H. Bunting, E. R. Reeves, H. C. Siddeley, W. J. Moggridge, J. A. Hirst, A. Eckstein, and S. Whipp.

OFFICIALS AND MEN ATTESTED.

Throughout the country, tramway, railway and omnibus employees of military age, i.e., between 19 and 40 years, have submitted themselves to medical examination with a view to being enrolled in Section B of the Army Reserve, under Lord Derby's scheme for the preservation of voluntary enlistment. It is left for their employers to claim before the local tribunals retention in civil employment of such men as they deem to be indispensable. A considerable number of men enlisted for immediate training in the early part of the special recruiting period that ended on December 11, but in the case of the employees of one London company there was a rush of men to join the reserve, or to secure the medical examiner's certificate of rejection during the last day of the period. In a number of places the eligible chief officials of transportation and electricity undertakings were attested, with the result that their release will have to be claimed.

A report recently issued by Manchester Tramways Committee stated that the number of men in the service of the department who had joined the colours before the end of November was 2,107, and the payments now being made in respect of those men are at the rate of £72,000 per annum. If all the available men of military age then with the department were to join the colours, the cost of making payments to those men or their dependants, in accordance with the Council's resolutions, would be about £110,000 per annum. This, the report stated, would be a serious drain upon the financial resources of the department. The general manager suggested and the committee approved the suggestion, that the men in the department's service who wished to join the forces should enlist under the group system (Section B, Army Reserve).

Arrangements were made for Bradford tramway employees who desired to enlist to be attested under Lord Derby's scheme for postponed service, but the tramways manager stipulated that they should first apply for permission, and each take to the recruiting officer a letter intimating that before any of the men were called up the department should have the opportunity of appearing before the local tribunal in the event of a man's services being considered indispensable to the working of the tramways.

Newcastle Corporation decided that employees who entered into military obligations up to December 11 should receive allowances for dependants when the men are called up. The Council are paying £37,215 per annum to dependants, and £13,919 in war bonuses to workmen.

A Question in Parliament.

In the House of Commons on Dec. 21, Mr. Hohler asked the Under Secretary for War what steps should be taken to secure that light railway and tramway companies were left with sufficient staffs to maintain the necessary minimum service and fulfil their obligations, especially in naval, military and munition centres; and would he direct that the appellate tribunals and the recruiting officer should consider the needs of the service as a whole and deal with the entire body of men attested.

Mr. Tennant replied: Skilled men in public utility services, such as tramways, waterworks, etc., are not accepted for immediate enlistment. If such men have been attested for Army Reserve Section B, under Lord Derby's scheme, a mark is made against their names in the army register, and they are not called up for military service unless their employers state that their services can be spared.

ADELAIDE AND LAUNCESTON TRAMWAYS LABOUR DISPUTE.

In the Arbitration Court at Melbourne, the Adelaide Municipal Tramways Trust, Launceston Municipal Council, and the tramway employees have registered agreements arrived at in connection with the demand of the men for increased wages and better conditions of labour. The agreements are to extend over three years. The rates to be paid are to continue until the revenues of the respective Corporations are more than sufficient to meet obligations, and a conference is to be held in August each year between representatives of each party to review the financial position and fix such wages as are considered justifiable. A Board is provided to deal with any disputes that may arise. It is also agreed that employees must within one month of joining the service become members of the Tramway Employees' Association.

NO OMNIBUSES IN PARIS.

The budget report of the Paris Municipality for 1916 gives the reason why the city has been without a motor omnibus service since the vehicles formerly in use were impressed by the military authorities in August, 1914. In the first place, no new omnibuses could be built as the factories were engaged on munition work. An equally important consideration was that, owing to the Government requiring so large a supply of motor spirit, no guarantee could be given that an adequate quantity could be obtained for omnibus use.

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THE EMPLOYMENT OF WOMEN.

EXPERIMENTS WITH WOMEN DRIVERS.

Glasgow Tramways Department are continuing the experiment of car driving by five young women, which has been in progress since November 1. The convener of the Tramways Committee was asked at a meeting of the City Council on December 9 if the experiment of appointing women car drivers had been a success, and if he would inform the Council what were the hours worked by these drivers, and what pay they were receiving. Councillor Montgomery replied that no proposal for the appointment of women car drivers had been before the committee, and it followed that the question of hours and wages for such work had not been considered. Mr. Dalrymple, the general manager, had placed a number of women on the cars as drivers, in order that he might be able, in the event of any emergency arising, to advise the committee as to the suitability or otherwise of women for this class of work.

Glasgow Tramways Committee have since asked the Council to approve of an extended test of women as drivers by provisionally increasing the number from five to thirty. The committee also reported that the number of female conductors now exceeds one thousand.

The uncertainty of retaining the services of the motormen who have passed into the Army Reserve under Lord Derby's scheme has led Mr. J. B. Hamilton, the general manager at Leeds, to make an experiment in the use of women as car drivers. A number of robust young women are being put through a course of instruction, so that a report can be made to the committee as to the prospect of filling vacancies from that source of supply.

A few women are engaged in similar work at Cardiff, Darlington, and Barrow.

Alderman H. Linsley, chairman of Salford Tramways Committee, has stated that the committee were not placing any obstacle in the way of their employees enlisting. There was a scarcity of competent male drivers. Salford was the first borough in Lancashire to introduce women conductors, and it was quite possible that women drivers would have to take the place of those who are volunteering for the front.

Women conductors are now almost universal in Great Britain. On the London County Council's cars they took up their duties on December 4, attired in neat grey uniforms and waterproof hats. At first they are being employed only on the single-deck cars and on the trail cars. The manner in which they are discharging their duties affords evidence of careful training.

Bradford City Council, on December 14, decided that an experiment in the employment of women as conductors should be made, the rates of wages and hours of duty to be the same as for men, except that the women should have longer meal reliefs. No woman now employed in the textile trade will be engaged. The Council accepted a labour amendment to dispense with all women employees at the end of the war.

Aberdeen Council have authorised the temporary appointment of a woman ticket inspector, and also of women as car cleaners. The inspector will be paid 35s. a week, and her duties will be restricted to the women employees.

WOMEN CAR DRIVERS IN BERLIN.

Notwithstanding that a previous trial had proved unsatisfactory, the Greater Berlin Tramways Company are again experimenting with women as car drivers. According to a report received in the autumn from Switzerland the management were endeavouring to secure men from neutral countries. Evidently that alternative has failed, for on December 19 an Amsterdam correspondent announced the receipt of a message from Berlin to the effect that the company find themselves compelled to fall back upon women to act as drivers, owing to several hundreds of motormen having been called up for army service. Many people, the report says, are protesting against the employment of females and threaten to boycott the cars driven by women, as they do not consider them strong enough to manage full-sized cars with safety to passengers and the street traffic.

CONCESSION ON EXCESS PROFITS.

In the House of Commons on December 7, on the resumed consideration of the Finance Bill, the Chancellor of the Exchequer moved an amendment to Schedule 4, providing that local authorities should be allowed to deduct from their excess profits the amount which had to be paid in respect of the sinking funds.

Mr. Rawlinson, Sir F. Banbury, and Mr. Stuart Wortley protested against preferential treatment of trading local authorities.

The amendment was agreed to, and the Bill passed the report stage, and was ordered for third reading.

At a meeting of Sheffield Corporation on December 8, the Chairman of the Finance Committee said the Chancellor also indicated that he would allow Corporations to pool all the trading departments. As an illustration, the Corporation anticipated a deficit of £20,000 on the water department this year, but they would be allowed to deduct that from the tramway profits before beginning to calculate as to excess profits.

WINTER UNIFORMS FOR WOMEN.

The accompanying illustrations show the neat and serviceable uniforms that have been provided for winter wear by the 60 women at work on the Oldham Corporation tramcars. The garments are made to a design registered by Mr. J. W. Dugdale, the general manager, who has been congratulated by the Tramways Committee upon the suitability of the outfit. Already it has been inspected by managers from other tramways.

The first picture shows the dress in which girls travel to and from duty, when they wear a skirt of ordinary length. The second photograph depicts the uniform that they wear when upon the cars. It is apparently a short skirt. In reality the garment is of the bloomer type, and there are also high cloth gaiters of the same material as the skirt and tunic. There is also a top coat of exactly the same length as the skirt, but of heavier material. The clothing was made by Briggs, Jones, and Gibson, Limited, of Manchester.

Off-Duty Uniform of Conductors at Oldham.

At Portsmouth the women have been given waterproof gaiters, a waterproof cover for the cap, a mackintosh, and an overcoat, in addition to their ordinary uniform.

Uniform Worn While at Work.

The outfit cost of the ten women conductors at Colchester is £3 19s. 6d. per head. They are provided with hat, tunic, skirt, south-wester, and oilskin coat.

A thaw following a heavy snowfall in Leeds on December 10 made matters trying for the 160 women conductors who were on duty. Only three, however, reported themselves as sick. The slush carried on to the platforms and the staircases made their skirts wet, and one woman came on duty the following day in a more fitting garb. She was wearing knee boots, and had fastened the skirt up out of reach of the stairs.

Mr. Arthur Ellis, general manager at Cardiff, has now secured bloomer skirts and long gaiters for the girls employed on the tramcars. In addition, their uniform comprises a greatcoat, mackintosh, and two hats. Girls are also employed in the parcels delivery department, and at Christmas a record number of parcels was dealt with.

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BRITISH COLUMBIA ELECTRIC RAILWAY.

Effect of the War.

The directors' report for the year ended June 30 gave the net revenue as £180,601. It has been decided to draw £60,000 from the reserve and pay 2½ per cent. on the preferred ordinary stock, leaving £6,667 to carry forward. The directors proposed to pay the dividend for the current year on the 5 per cent. preference stock out of the reserve, being of the opinion that the company's financial position justified that course. They were unable to hold out any hope of being able to recommend the payment of any dividend on the preferred ordinary or deferred ordinary stocks for the present year. Owing to the war, and especially to the resultant paralysis of the shipping trade, commercial depression had prevailed throughout British Columbia, which had brought about an almost complete cessation of expenditure by the Government, municipalities, railways and other large undertakings. On June 30 the wages agreement terminated, and the Board of Arbitration made an award, reducing the rate of wages paid to the employees by about 8 per cent., which would represent a saving of about £22,000 per annum. The expenditure on capital account during the year had been $875,558, which compared with $4,110,327 for the previous year.

At the annual meeting of shareholders held on December 30, at Liverpool Street Hotel, London, Mr. Harold G. Brown read the speech prepared by Mr. R. M. Horne-Payne, the chairman of the company, who stated that British Columbia had suffered from the effects of the war very acutely, owing to shipping facilities practically ceasing to exist during the early part of the war, because of the presence of the German Fleet in the Pacific Ocean, and in consequence of the great demand and high prices paid for ships. Rich men had lost their fortunes, artisans and labourers had been thrown out of employment; industries had been closed down, and property which was worth many thousands of dollars had been sold to realise the taxes due upon it. There had resulted a commercial paralysis which had produced so great a falling-off in the receipts of the company that it was probable it would not earn in the current year more than sufficient to pay its debenture interest. Fortunately, the war did not find them in a weak position as regards cash resources, and by immediately cutting down capital expenditure and enforcing rigid economy, the position had been strengthened, and the company was in a position to withstand even the present acutely bad times. Unfortunately, as events had turned out, they had extended their tramway system and increased the equipment and power plants largely beyond the requirements of the business at present available, and had, for the time being, large amounts of capital unremuneratively employed. For instance, the power plants on the mainland and Vancouver Island had cost $13,475,000, and were capable of producing about twice as much power as was required at present.

Jitney Motor Competition.

The depression had been accentuated by the jitney motor competition, which had, however, fallen off during the winter. The general manager held the opinion that they would not be troubled so much next summer with the jitney motor. The company had struggled to maintain an efficient service throughout all their districts. At present the jitneys took the cream of the traffic in the more thickly populated centres. It was impossible for the jitneys to supply the needs of the outlying districts at anything like the fares the company charged, but if the people insisted upon supporting this unfair competition in the thickly populated areas, the company would have no alternative but to leave some of the outlying districts without travelling facilities. Every effort had been made to strengthen the company's friendly relations with the municipalities, and although the Board had been compelled to refuse many requests involving expenditure of money, it was hoped that the municipal authorities were beginning to appreciate the company's difficulties, and to see that the interests of the company and the community were identical. As the result of the wonderful crop, and the stimulus given to every branch of manufacture by the increased spending power derived from it, and also from the large munition orders, a great revival of trade had taken place in the Eastern and Central provinces. The Panama Canal and the Canadian Northern Railway across the Continent to Atlantic would prove most powerful factors in hastening the development of British Columbia on the return of normal conditions. In conclusion, the chairman referred to the enthusiasm of British Columbia in sending men to fight for the Empire.

Efforts to Obtain Fair Regulations.

In reply to questions, the chairman said he thought that the ordinary motor car could not subsist for any length of time on the fares they were getting. On the other hand, it was possible that some form of vehicle would develop that would be a serious competitor with the tramways. The competition up to the present had been largely from owners of motor cars, and they would have to wait to see what was the final result. If a motor car operating in the heart of the city and taking the cream of the traffic was unregulated it could be made to pay. The directors had been striving to get fair regulations, and he hoped they would succeed. With regard to the provision for renewals maintenance, he would ask the stockholders to allow the directors to keep up this provision. One permanent and satisfactory feature was that in this time of stress they had plenty of money in hand.

The report was adopted, and Messrs. E. L. Evan-Thomas and T. Blundell Brown were re-elected directors. A reference to the general manager and staff will be found in our "Personal" columns.

FINANCIAL REPORTS AND MEETINGS.

Manila Electric Railroad and Lighting Company.—A quarterly dividend of 1½ per cent. has been paid.

Shell Transport and Trading Company have declared an interim dividend of 10 per cent., free of income tax.

Brazilian Traction, Light, and Power Company.—Quarterly dividend of 1½ per cent. on the preference shares is announced.

Canadian General Electric Company.—For the quarter ending December 31, the board have declared a dividend at the rate of 7 per cent. per annum.

Yorkshire (West Riding) Electric Tramways Company.—An interim dividend at the rate of 6 per cent. per annum on the preference shares is announced.

Melbourne Tramway and Omnibus Company.—The directors have declared a dividend of 6d. per share for the quarter ended December 31, and also a bonus of 1s. per share.

Blackpool, St. Annes, and Lytham Tramways.—The accounts for the year ended October 31, after providing £7,500 for interest on debenture stock and £1,500 for sinking fund, show a debit balance to be carried forward.

Manx Electric Railway Company.—The accounts for the year ended September 30 show a loss of £9,436. The debenture interest (£9,000 per annum) was paid in cash for the first half-year, and funded by the issue of second debentures for the second half.

Belsize Motor Company's Dividend.—As the result of the past year's trading, the directors recommend a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the twelve months, adding £25,000 to the reserve, making that fund £75,000, and carrying forward £10,312 subject to fees.

India-rubber, Gutta Percha, and Telegraph Company.—The net profits for the year ended September 30 were £80,404. A final dividend of 15s. per share is proposed on the ordinary shares, making 10 per cent. free of income tax for the twelve months, and carrying forward £18,938 subject to excess profits duty.

Halifax Tramways and Electricity Profits.—In his annual report on the Corporation's accounts for the year ended March 31, the borough treasurer states that the electricity works profit was £13,036, equal to 4·29 per cent. on the capital expenditure. On the tramways the net surplus was £16,211, or 3·87 per cent. on total expenditure.

Burmah Electric Tramways and Lighting Company.—The directors have declared a dividend of 5 per cent. (5s. per share) on 6 per cent. preference shares for the period from February 1, 1906, to November 30, 1906, leaving 52 per cent. in arrear, adding £2,000 for the depreciation account, making £18,394, and carrying £842 forward.

Bombay Tramways and British Income Tax.—At a meeting on December 18, in India, of shareholders on the Indian register of Bombay Electric Supply and Tramways Company, the chairman (Sir Sassoon David) said legal opinion in England and India agreed that the only means by which the company could escape from liability to pay income tax in England was by transferring the management to Bombay. Resolutions, providing for alterations in the constitution of the company, were adopted.

The Half-year at Bournemouth.—In his report on the tramways undertaking during the half-year ended September 30 last, Mr. I. Bulfin, general manager, states that the receipts show an increase of some £2,618 on the corresponding period of last year. The working expenses, £30,973, include the extra cost of materials, the amounts paid to dependants of men who have joined the army, and the war bonus to the staff. The working costs show a decrease of some £600 to £700 on last year's figures. The gross balance is £28,940, as against £25,647, an increase of £3,293. The percentage of working expenses to receipts works out at 51·76, the lowest figure yet obtained. Receipts per car mile, 16·55d., 2d. more than in any similar period.

Selsey Tramways Company.—At the annual meeting held at Chichester, it was reported that the gross receipts were £3,553. After meeting interest on debentures and mortgage loans, there was a balance of £21 to be carried forward. Mr. Heron-Allen (chairman) said what was required was to make the line commensurate with the needs of Chichester and Selsey. Selsey seemed to grow in attraction every year, and commercially it was extremely prosperous owing to the influx of visitors. The shareholders should take their courage in both hands and do something to make the line worthy of the services it was expected to perform. Thanks were expressed to the managing director, Mr. Street, and to the secretary and manager, Mr. H. G. Philips.

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Provincial Tramways Company.—Presiding at the annual meeting, Mr. A. Beattie said that the profits were better than usual, a fact which was due to their undertakings in the south of England. In the north, however, the war had affected them adversely, especially at Grimsby. Many of the employees had joined the army, and in allowing all eligible men to go the directors thought they were doing as much as by paying any excess profits to the Government. It was certain, however, that a great amount of money would be wanted to pay for the war, and they would no doubt be heavily taxed on their profits. Mr. S. Hern was re-elected a director, and, acting on a suggestion made by a shareholder, Mr. Supple, of Dublin, the meeting voted a bonus of £600 to the directors for their services.

Coventry Chain Company.—The net profits of the Coventry Chain Company for the year ended August 31 were £21,972, and £3,461 was brought forward. A dividend of 8 per cent., and a bonus of 2 per cent., was proposed on the ordinary shares, adding £5,961 to the reserve fund, and carrying forward £9,348. At the annual meeting at Coventry, on December 17, Mr. Norman Hill, who presided, proposed a dividend of 10 per cent. on the ordinary shares for the past year. He said the immediate effect of the new capital issue was the disappearance of the overdraft and mortgages to the bank, and a considerable increase in investments. Both works are almost exclusively engaged on war work. Another successful year was anticipated. Messrs. T. J. Keegan and R. S. Cattanach were re-elected directors.

Costa Rica Electric Light and Traction Company.—The net earnings in Costa Rica for the year ended June 30, 1915, amounted to £21,662, a decrease of £4,689, mainly due to the adverse exchange. During the year the gold premium has averaged 150 per cent., as against 112 per cent. for the previous year. There is a net surplus of £3,833, which sum the directors propose to carry to the credit of discount and commission on debenture issue account. The power plant at El Brasil has worked well throughout the year. Some trouble that was experienced in times of flood has been eliminated by the installation of larger sluice gates. The business of the company has suffered from the interruption of exports and general dislocation of trade, but in view of the serious loss entailed by the high rate of exchange, the directors consider the result very satisfactory.

Cordoba Light, Power, and Traction Company.—For the year ended September 30 the net profits were £19,034, and £26,320 was brought forward. In future, dividends will be paid on the preference shares for the periods ended September 30, and a final distribution on those shares for eight months at the rate of 6 per cent. per annum is proposed, carrying forward £26,580. Mr. G. A. Touche, M.P., presiding at the annual meeting on December 16, said the gross receipts of the combined businesses amounted to £157,590, compared with £160,420 in 1914 and £154,060 in 1913. The operating expenses were £1,360 higher, in part due to the coming into force of an increased percentage payable to the Government. The net receipts were £83,320, compared with £87,510 in 1914 and £80,830 in 1913. The percentage of expenses to the gross receipts of the two undertakings was as follows:—1913, 47·5 per cent.; 1914, 45·4; and 1915, 47·1. The results were better than might have been expected, and reflected credit on Mr. C. C. Lewis, the excellent manager at Cordoba, and on the staff.

Blackpool, St. Annes, and Lytham Tramways, Limited.—Mr. G. Nicholson presided at the annual meeting at Liverpool, on December 17. The report referred to the gratifying increase in the receipts and the improved profit upon the year's working, and stated that the trustees for the debenture holders had intimated their intention of distributing 4 per cent. interest on account of arrears of interest. Traffic receipts were £34,872, and the net receipts £29,159, the balance to the profit and loss account being £7,594. The chairman remarked that the balance sheet was the most satisfactory since the inception of the company. The receipts showed an increase of £4,300, due to the fine weather in September and October. Sixty-three of their staff had joined H.M. Forces, and he regretted that three had been killed in action and six wounded. The manager had employed girl conductors to the number of 30, and they had given every satisfaction. Their wages came to rather more than the men because they only worked 8½ hours daily, against 10 by the men. The company had paid £307 to the dependants of employees. The report was adopted, and Mr. T. Preston was re-elected a director.

Isle of Thanet Electric Tramways and Lighting Company.—In their report for the year ended September 30, the directors record a profit balance of £10,050, compared with £18,063 for 1913–14, and £21,635 for 1912–13. Of the first-mentioned sum, £303 was derived from profit on the motor omnibus services. These vehicles stand at a value of £1,567 in the balance sheet. The total traffic receipts of the two departments were £22,752, while from the sale of electricity £8,011 was derived, and £151 from carriage of parcels. The report proceeded:—"Owing to the absence of visitors, on whom the prosperity of the district depends, and to the restrictions on lighting, both the tramway traffic and the sale of electricity have suffered severely from the war. The receipts, which were £48,507 in 1912–13, the last complete financial year before the outbreak of hostilities, fell last year to £31,589, a difference of £16,918, while the saving in expenses was only £5,333, owing to standing charges that could be only gradually reduced and to the increased price of coal. The directors expect to reduce the expenses further during the current year. Notwithstanding the unfortunate conditions prevailing, the profits proved sufficient to pay all the interest charges, and to allow of £974 being carried forward. In view of the continued depression which existed during the whole year, the directors regret that they did not find themselves justified in making the payment of 2½ per cent. on the preference shares foreshadowed in their last report. The prospects of the undertaking were most promising when they were so suddenly affected by the outbreak of the war. The company had just completed large extensions of their generating plant, and were in an excellent position to meet the growing demands for light and power, and the increasing traffic on the tramways." The board waived £575 of the sum of £900 due to them as fees.

Oldham Corporation Tramways.—A deficiency of £5,217 resulted from the working of this undertaking during the year 1914-15, a period including eight months of the war. Forty per cent. of the employees had joined the forces at the end of the financial year, and the sum of £2,121 paid to their dependants has been charged to the revenue account. In consequence of the depletion of the staff the holidays of the traffic employees had to be cancelled, but double pay was given for the time that would have been allowed as leave. On Christmas Day an addition of one shilling was made to each man's pay. The following table gives the principal statistical items for the past two years:—

	1914-15.	1913-14.	Inc. or Dec.
Capital expenditure	£453,655	£444,563	+ £9,092
Loans outstanding	£317,878	£318,196	- £318
Track mileage (single)	77	36	+ 1
Number of cars in stock	97	92	+ 5
Traffic revenue	£111,679	£114,480	- £2,801
Total revenue	£113,814	£116,169	- £2,355
Working expenses	£85,083	£78,303	+ £6,780
Gross balance	£28,730	£37,866	- £9,136
	Deficiency.	Surplus.	
Net balance	£5,217	£5,026	—
Passengers carried	22,171,712	22,773,108	- 601,396
Average fare per passenger ...	1·10d.	1·10d.	..
Car mileage	2,045,840	2,077,104	- 31,264
Units per car-mile	1·544	1·585	- ·41
Power cost per car-mile	2·316d.	2·376d.	- ·060d.
Traffic receipts per track mile ...	£3,018	£3,136	- £118
Traffic receipts per car-mile	13·351d.	13·422d.	- ·071d.
Expenses per car-mile	9·981d.	9·047d.	+ ·834d.
Ratio of working expenses	74·75	67·40	+ 7·35

Cardiff Corporation Tramways.—When the city treasurer presented his annual report on the financial results of the tramways and electric lighting for the year ended March 31 last, Sir J. W. Courtis, chairman of the committee, remarked that notwithstanding the adverse conditions owing to the war, the year's working had resulted far more favourably than had been anticipated. The report has now been published in volume form, together with the report of Mr. Arthur Ellis, the tramways manager and borough electrical engineer. At the beginning of July, 1914, the traffic receipts showed an increase of £3,000, but there was a steady decrease week by week, until at the end of the financial year the war brought about a total decrease of £2,846. After providing for depreciation fund the available surplus was £10,002, and of this sum the Committee decided to transfer £9,120 to the reserve fund and £881 to capital account. The reserve fund would then amount to £9,963. Mr. Ellis states that it is necessary that a substantial reserve should be built up, out of which could be defrayed the cost of installing a more modern power plant. The following statement gives the principal statistical items for the past two years:—

	1914-15	1913-14	Inc. or Dec.
Capital expenditure	£811,043	£786,510	+ £25,533
Loans outstanding	£485,049	£514,059	— £29,010
Total track mileage	31 m. 66 ch.	31 m. 66 ch.	—
Number of cars in stock	130	130	—
Traffic revenue	£138,672	£141,519	— £2,847
Total revenue	£164,683	£166,200	— £2,517
Working expenses	£97,360	£99,064	— £1,704
Gross balance	£68,446	£68 384	+ £62
Net profit	£16,949	£18,594	— £1,645
Passengers carried	30,424,407	31,122,962	— 698,555
Average fare per passenger	1·09d.	1·09d.	—
Car mileage	2,742,546	2,966,230	— 223,684
Units per car mile	1·80	1·71	+ ·9
Power cost per car mile	·835d.	·850d.	— ·15d.
Traffic receipts per track mile ...	£4,358	£4,448	— £90
Traffic receipts per car mile	12·14d.	11·45d.	+ ·69d.
Expenses per car mile	7·028d.	6·781d.	+ ·247d.
Ratio of working expenses	56·9 p.c.	58·2 p.c.	— 1·3 p.c.

Allowances to dependants of employees who had joined the forces cost £5,720 per annum, and the bonus granted to employees £2,000 per annum. Power station expenses showed an increase of only £333, although the output increased over half a million units.

Chas. Macintosh and Company's War Relief Fund.—The employees of Chas. Macintosh and Company, Limited, india-rubber and tire manufacturers, of Manchester, during the first year of the war have contributed £2,239 to various relief funds. To that total the company added an equal sum, bringing the aggregate to £4,478.

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CONTRACTS AND ORDERS.

Wolverhampton Tramways Committee have accepted the tender of Hadfields, Limited, for the supply of 14 pairs of points.

Dunlop Tyre Company have received a contract at 1d. per car mile, for supplying rubber tires to the railless trolley vehicles of Aberdare Council.

Glasgow Tramways Committee have accepted the tender of the British Insulated and Helsby Cables, Limited, for the supply of copper trolley wire.

Noyes Brothers' tender for the supply of overhead equipment has been accepted by Prahran and Malvern Tramways Trust (Victoria), at £4,116.

The Anger Manufacturing and Supply Company, Limited, have received the order to supply all cars of the Preston Corporation Tramways with two jacks.

Newport Council have purchased Bedwas navigation coal at 14s. 6d. per ton, and Crumlin Valley coal at 12s. per ton, both in 300 ton lots, for their electricity works.

Portsmouth Council have placed tenders for the supply of uniforms for motormen and conductors at prices 10 per cent. above those paid under the contract made in November, 1913.

Tudor Accumulator Company have offered to maintain for five years the battery of a new 30-cwt. electric vehicle acquired by the Metropolitan Asylums Board for use at Queen Mary's Hospital.

Southampton Tramways Committee have allotted contracts as subjoined:—Lancashire Dynamo Company, motor generator £181, switchboard £100; Thermit, Ltd., welding 140 rail joints at 25s. per joint.

Public Services Tender Board, Wellington (N.Z.) have accepted the tender of Turnbull and Jones, Limited, for the supply of 120 miles of copper cable, at £3,460. There were seven tenders, the highest being £4,269.

Luton Electricity Committee have recommended the acceptance of the tender of the Davenport Engineering Company for water cooling plant of 180,000 gallons capacity, at £1,460, and of Messrs. Johnson and Phillips for switchgear, at £860.

The British Thomson Houston Company, Limited, of Rugby, about a year ago supplied to the Nuneaton Corporation a 750-K.W. geared Curtis turbo-generator. This set has worked so satisfactorily since its installation that the Nuneaton Corporation have placed an order for a duplicate set, to be delivered in the near future.

Siemens Brothers' Dynamo Works, Limited, have received an order for the supply of Wotan, Tantalum and carbon lamps to the Aberdeen Line for the year 1916. The company were the successful tenderers for supplying Wotan and carbon filament lamps to the Royal Mail Steam Packet Company for twelve months from January 1, 1916.

Stockport Council have accepted the following tenders:—Tramway stores: Dick, Kerr and Company, Limited, H. Hollingdrake and Son, British Thomson-Houston Company, Limited, Baxendale and Company, Wilkinson, Heywood and Clarke, Liverpool Jute Bag Company, Spicer Brothers, Limited, Rostron Brothers, McClure and Whitfield, Brecknell, Munro and Rogers, and Brush Electrical Engineering Company.

Victorian Railway Commissioners have placed contracts as appended:—Siemens Bros.' Dynamo Works, British Insulated and Helsby Cables, Limited, and Australian General Electric Company, electric lighting material for Jomont car repair shop; Gibson, Battle and Company, drilling machine; Noyes Brothers, electric light wire and lathe for turning and grinding commutators of traction armatures; Lascelles Parrington, motor generator, switchboard and accessories for battery charging; Babcock and Wilcox, Limited. 5-ton electric crane.

PERSONAL.

Mr. R. H. Scotson has been appointed electrical engineer to Middlesbrough Council.

Mr. C. E. Garnett, electrical engineer to Darwen Corporation, has enlisted under the group system.

Mr. W. G. Snell, tramways manager to Perth Corporation, has attested for the Army Reserve.

Mr. R. H. Scotson, deputy manager at Middlesbrough, has been appointed borough electrical engineer.

Mr. E. Combdy, of Rugby, has been appointed mechanical engineer at Huddersfield Corporation electricity works.

Councillor D. T. J. Lyle has been re-elected chairman of Maidstone Corporation Light Railways Committee.

Mr. F. J. S. Hosken, general manager and engineer, Darwen Corporation Tramways, has enlisted under the group system.

Mr. J. W. Bachelor, of Hendon, has been appointed station superintendent at Walthamstow Council's electricity works.

Mr. R. E. Armstrong, charge shift engineer at the Greenwich generating station of the London County Council, has resigned.

Mr. H. Broadbent, formerly chief electrical engineer to Perth Corporation, is now engaged at Kynoch's munition works, Birmingham.

Mr. E. Lunn has been appointed station superintendent at Huddersfield electricity works, the vacancy having been created by the death of Mr. Whitwam.

Mr. J. E. Starkie, Burnley borough electrical engineer, is one of 25 out of 26 eligible members of the staff of the electricity department who have passed into the Army Reserve.

Mr. H. S. Ellis, borough electrical engineer at South Shields, and the remaining 11 eligible employees of the electricity department, have been enrolled in the Army Reserve.

Mr. J. A. Forde, general manager and electrical engineer, Isle of Thanet Electric Tramways and Lighting Company, has attested for military service under Lord Derby's recruiting scheme.

Major Fred Coutts, 5th Black Watch, has received the Territorial Officers' Decoration for twelve years' service. Major Coutts is general manager and electrical engineer to Paisley Tramways.

Mr. S. Antwis, on retiring from the staff of the Wolverhampton Works of the Electric Construction Company, Limited, has been presented by the employees with a purse of Treasury notes. Mr. Antwis has seen 32 years' service.

Mr. T. Hanlon, on leaving the Isle of Thanet Tramways and Lighting Company to take an appointment with the Oxford Tramways Company, has been presented by the staff with a brass gong, suitably inscribed, and a pipe and pouch.

Councillor F. E. Howse, chairman of Wallasey Corporation Tramways Committee, Councillor H. W. Griffin, vice-chairman, Councillors Nesbitt and Quinn, and Mr. R. R. Green, the general manager, have been appointed members of the Munition Committee.

Mr. J. Dalrymple, general manager, Glasgow Corporation Tramways, has been agreed upon by Sheffield and Rotherham Tramways Committees as the arbitrator to decide the question of running additional cars for munition workers between the Hadfield works and Tinsley terminus.

The Directorship of Labour Supply.—Mr. James Currie, C.M.G., has been appointed to give effect to the policy of the Labour Supply Department of the Ministry of Munitions in relation to training of munition workers. Mr. Currie was principal of Gordon College, and Director of Education in the Soudan from 1900 to 1914.

Dr. F. S. Pearson, of Great Barrington, Massachusetts, U.S.A., and London, head of the Brazilian Traction Light and Power Company, Barcelona Traction Light and Power Company, Mexico Tramways Company, and other undertakings in Mexico, who was drowned in the *Lusitania* on May 7, has left property in this country of the value of £328,960.

Sir Arthur Yorke, C.B., has been elected a director of the Grand Trunk Railway of Canada to fill the vacancy caused by the death of Lord Welby. Since his retirement from the position of chief inspector in the railway department of the Board of Trade, Sir Arthur has been a director of the Great Western, South Eastern, and London and Chatham Railways.

Mr. W. H. Ellis, assistant mains superintendent of the Corporation Electricity Department, has been appointed by Chester Council to the new office of traffic superintendent of the Chester Electric Tramways, which has been created since the death of Mr. John Gardner. Mr. Ellis is lecturer in electrical engineering at the Chester Grosvenor Museum, and has been in the service of the Corporation for about 18 years. He is a freeman of the city.

Alderman J. H. Aston declined to accept the chairmanship of Huddersfield Tramways Committee for another year, ill-health compelling him to give up some of his public work. Important extensions were made during the time he presided over the committee. The services were increased and improvements were made which have resulted in greatly improved financial records. The committee have expressed regret at his resignation, and placed on record their high appreciation of the service he has rendered during nine years as chairman. Councillor E. H. Sellers, deputy chairman, has been elected chairman, and Councillor T. Cowley vice-chairman.

Mr. Edward Lafferty, traffic manager of Preston Corporation Tramways, has been appointed to a similar position with Edinburgh Tramways Company, at a salary of £300 per annum. Mr. Lafferty served as conductor, driver and timekeeper in Bradford, and he received promotion when steam and electric traction were introduced there, ultimately becoming a traffic inspector. In 1904 he was appointed traffic manager at Preston. In Bradford he served under Mr. C. W. Shepherd, who was traffic superintendent. Subsequently Mr. Shepherd went to Edinburgh to fill a similar position, and he has for some years combined that office with the position of general manager and secretary.

Mr. G. Kidd, general manager, British Columbia Electric Railway, the officers and staff, at the annual meeting of the company in London, were accorded a hearty vote of thanks "for their untiring services in the performance of their very arduous duties." In proposing the resolution, Mr. Harold Brown said that if ever there was a year in which the local management had earned the gratitude and thanks of the stockholders it was the past year. The task of a manager who had to economise in every possible way was difficult and

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disagreeable. He had to dispense with the services of men who had been in the company's employ for many years; he had to meet the demands of local authorities and the population; and had to refuse to consider things that in the ordinary way they would probably undertake as a matter of course. That was not only disagreeable, but it was calculated to make a general manager most unpopular. Mr. Kidd had faced that disagreeable duty in a very efficient manner. He was supported by a very efficient, though now a comparatively small, staff.

Mr. Thomas Clarkson was re-elected a director of the National Steam Car Company with acclamation. Mr. Aylmer Maude, in proposing the re-election, said Mr. Clarkson was not only the inventor of the company, but the managing director and chairman. The company's success reflected more credit on Mr. Clarkson than was sometimes realised. When the National Steam Car was put on the streets of London there was no very serious opposition, and the most important omnibus company at that time was running very poor motor vehicles. Later on they were met with the formidable competition of the London General Omnibus after it had been re-formed. It was remarkable that so small a company as theirs then was should have kept its feet and lived to submit such a good balance sheet as on the present occasion. That result was chiefly due to the efforts of Mr. Clarkson. The strike trouble was handled by him with promptitude and firmness, and they might congratulate themselves upon coming through it with so little loss. Mr. K. P. Hawksley was also re-elected a director.

Mr. Charles Owen Silvers, assistant manager of Wolverhampton Corporation Tramways, has been appointed general manager and engineer in succession to the late Mr. W. A. Luntley. Alderman S. Craddock, vice-chairman of the Tramways Committee, in proposing Mr. Silvers' appointment, said that he had a unique knowledge of the Lorain tramway system, and during Mr. Luntley's illness he had performed excellent work. The salary will be £350 per annum, rising to £500, and by a rearrangement of the staff the Corporation will effect considerable saving. In 1901 Mr. Silvers was articled to Mr. C. E. Shawfield, at that time the electrical and tramways engineer at Wolverhampton. Mr. Silvers superintended the electrical equipment of the tramways and cars in that town, and was subsequently appointed assistant engineer, in which capacity he had charge of construction and repair work. In 1910–11 he became assistant engineer in the rail welding department of the Tudor Accumulator Company, but in September, 1911, he returned to Wolverhampton as tramways engineer and deputy manager. When Mr. Luntley was laid aside by illness in March last, Mr. Silvers took sole charge.

Mr. Thomas Parker, managing director of Thomas Parker, Limited, died on December 5, at Trowbridge. In 1884 Mr. Parker designed and laid down the electric plant of the Blackpool Tramways. His original business was disposed of in 1888, to the Electric Construction Corporation, to which he acted for five years as engineer and manager. Amongst the contracts carried out under his direction was the electrical equipment of Liverpool Overhead Railway, and he designed Burnley electricity works. He was also concerned in supplying plant to the power stations at Manchester, Oxford, Chester, and Morecambe, and also for Birmingham Tramways Company. Along with the late Dr. Parshall, he was one of the arbitrators appointed to decide upon the system of electrification to be used by the Metropolitan District Railway, and he was consulting engineer to the Metropolitan Railway during electrification.

WITH THE FORCES.

Mr. E. S. Riley, superintendent at the Walthamstow Corporation electricity works, has joined the forces.

Mr. H. Gray, borough electrical engineer, Accrington, is serving with the Accrington and Burnley Howitzer Brigade.

Mr. F. E. Saunders, of Messrs. Balfour, Beattie and Company, Limited, has been gazetted to the Royal Engineers.

Mr. P. L. Gold, Northampton goods agent, Midland Railway, has been gazetted second lieutenant in the Royal Warwickshire Regiment.

Mr. A. Cooper Rawson, owing to his naval duties, has found it necessary to resign his membership of the Highways Committee of London County Council.

Mr. F. B. Mildmay, M.P., who has been elected to the directorate of the Great Western Railway, is serving with the British Expeditionary Force in France as an interpreter. The hon. member is a lieutenant-colonel in the West Kent Yeomanry.

Mr. Cottle, borough surveyor of Douglas, has been congratulated by the Corporation upon being offered a commission as lieutenant in the Royal Engineers. His position is to be kept open for him, and the difference between his salary and the army pay made good.

Electrical Engineers on Service.—In his recent inaugural address to the Institution of Electrical Engineers, Mr. C. P. Sparks, the new president, said that their hearts went out to the 1,500 members who were on active service. The bulk of the 7,000 members of the Institution were engaged in maintaining public services or directly or indirectly in the manufacture of munitions.

Company-Sergeant-Major Lindsay, 4th Loyal North Lancs. Regiment, who has been awarded the distinguished conduct medal for conspicuous bravery in France, was on the staff of the United Electrical Car Company, Limited, at Preston, when the war broke out.

Tramway Engineer as Workshop Officer.—Lieutenant S. W. Carty, late assistant electrical engineer of the Liverpool Corporation Tramways, who for some time past has been workshop officer to a divisional ammunition park in England, is again proceeding to the front. Mr. Carty obtained a commission in December, 1914, and was appointed workshop officer to the Anti-Aircraft Section, British Expeditionary Force, France. He was subsequently appointed workshop officer to the transport at one of the bases.

Colonel Lord Montagu of Beaulieu joined the torpedoed P. and O. liner *Persia* at Marseilles, for conveyance to Bombay, in order to take up a new appointment as inspector of mechanical transport vehicles. As his name did not appear in the first list of passengers saved, fears were expressed that he was one of the victims of the piratical and murderous enemy, but on January 4 news arrived that he had reached Malta after going down with the vessel and being several days in an open boat. Lord Montagu drove the first motor car into Palace Yard, and also gave King Edward his first motor drive. He made an unsuccessful attempt in the House of Lords to upset the resolve of both Houses to impose a road charge on omnibuses using the projected new western outlet from London.

Manager-Engineer's Release Sought.—Aberdare Council have applied to the War Office for the release of Mr. A. J. Abraham, general manager and electrical engineer of the Council's tramways and electricity departments. Mr. Abraham has received a commission in the Sherwood Foresters, and the Council maintain that their undertakings will be in a serious position if he is not returned to them. In the event of a refusal the clerk is to apply for the return of Mr. W. T. Hilder, outside mains superintendent, who has joined the R.E. Application is to be made to the local tribunal to permanently postpone the calling up of Messrs. H. T. Goldsworthy (accountant), A. Watkins (deputy clerk), A. S. Morris (deputy surveyor), and G. D. Morgan (chief clerk, tramways department).

NEW YEAR HONOURS.

Mr. S. E. Palmer, a new baronet, is deputy chairman of the Great Western Railway.

Sir Frederick Banbury, who becomes a member of the Privy Council, is a director of the Great Northern Railway.

Mr. R. Woodburn-Gillan, C.S.I., a recipient of the Order of the Star of India, is president of the Railway Board of India.

Sir Alexander Henderson, Bart., M.P., elevated to the peerage, has for several years been chairman of the Great Central Railway.

Sir Thomas Shaughnessy, K.C.V.O., a new peer, is president of the Canadian Pacific Railway, and a director of several railway companies connected with the Canadian Pacific.

Mr. W. W. Hoy, general manager of Railways and Harbours, Union of South Africa, becomes a Knight Bachelor. Mr. Hoy greatly aided the raising and despatch of General Botha's force against German East Africa.

Colonel H. C. L. Holden, C.B., a member of the Royal Automobile Club, and last year's president of the Institution of Automobile Engineers, has been appointed K.C.B. in recognition of his services during the war. Colonel Holden is assistant director of Supplies and Transport, War Office.

Mr. W. Middlebrook, one of the Members for Leeds, received a knighthood. He has been Mayor of Morley and Lord Mayor of Leeds. In the House of Commons he has rendered excellent service as chairman of Private Bill Committees, and has shown an interest in the question of road charges levied on omnibuses and railless trolley cars.

The Most Hon. the Duke of Devonshire, G.C.V.O., on the occasion of the New Year, was created a Knight of the Garter by the King. On becoming Civil Lord of the Admiralty in the Coalition Ministry, he relinquished the position of chairman of the Furness Railway. In 1912 the Duke was chairman of the United Kingdom Railway Officers' and Servants' Association.

Mr. F. H. Dent, one of the new knights, is general manager to the South Eastern and Chatham Railway Companies' Managing Committee, and was formerly with the London and North Western Railway. During the war he has been a member of the committee entrusted with the management of the railways for the Government, and his services to France have been recognised by the French Government.

Mr. George Franklin, of Sheffield, received a knighthood. Sir George is head of a firm of chartered accountants, of Sheffield and London. He is Pro-Chancellor of Sheffield University, a director of Lanarkshire Tramways Company, British Thomson-Houston Company, and several telephone companies abroad, including Constantinople. He was also chairman of the late National Telephone Company. In 1897-8 he was Lord Mayor of Sheffield, and he has for many years worked for the improvement of education facilities.

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RAILWAY OFFICERS AND STAFF.

Mr. A. G. Reid has resigned his position as general manager and secretary of Dublin and South Eastern Railway.

Mr. R. J. Patrick has been promoted to the post of district goods manager for the Glasgow and Western District of the Caledonian Railway.

Mr. J. J. Petrie, traffic manager, Midland and Great Northern Joint Railway, has been elected to the board of the Railway Benevolent Institution.

Mr. Frank Potter, general manager, Great Western Railway, has been appointed chairman of the Board of Management of the Railway Benevolent Institution.

Mr. H. Marriott, chief goods manager, Lancashire and Yorkshire Railway, has been re-elected chairman of the Irish and English Goods Traffic Conference for 1916.

Mr. F. Tatlow, principal assistant to the general manager, Midland Railway, has been appointed assistant general manager. His whole career has been with the Midland Company.

Mr. A. B. Richardson, son of Mr. J. Richardson, outdoor locomotive superintendent, London, Brighton and South Coast Railway, has been appointed locomotive superintendent of the Emu Bay Railway, Tasmania.

Mr. W. Slater, deputy assistant goods manager, Lancashire and Yorkshire Railway, has been presented with a silver tea service and a lady's satchel as a wedding gift from the goods manager's office staff at Manchester.

Mr. R. E. L. Mannsell, chief mechanical engineer, South Eastern Railway, has succeeded Mr. A. G. Hill, chief mechanical engineer, Great Eastern Railway, as President of the Institution of Locomotive Engineers for 1916.

Mr. P. P. Higgins, locomotive engineer of the Cyprus Government Railways, has been appointed superintendent of railways and engineer of ways and works in the Cameroons, the captured German West African territory.

Mr. W. H. Morton has been appointed locomotive superintendent of the Midland Great Western Railway, Ireland. Mr. Morton, who has been with the company since 1900, was formerly chief draughtsman to Messrs. Kitson and Company, locomotive builders, Leeds.

Mr. E. Moore has been presented with some valuable gifts and an illuminated address by the chief and district officers of the Great Eastern Railway on retiring from the position of solicitor. The presentation was made by Mr. H. W. Thornton, general manager.

Mr. R. M. Wilson has resigned the position of chairman of the Highland Railway Company, owing to indifferent health and the war work he is doing in the South. Mr. W. Whitelaw, the deputy chairman, has been appointed to the vacancy, while Mr. A. E. Pullar, Perth, has been elected deputy chairman.

Mr. J. A. Hookham, works manager, North Staffordshire Railway, has been appointed locomotive, carriage, and wagon superintendent of that railway. He began his career as a pupil on the London, Chatham and Dover Railway, and in 1900 he was appointed locomotive superintendent of a railway in Brazil, which two years later was taken over by the Government.

Great Western Appointments.—On the retirement of Mr. W. K. Laurence at the end of December from the position of divisional engineer at Bristol, Mr. H. R. K. Woodward, divisional engineer, Shrewsbury, was appointed to the vacancy. Mr. R. C. Sikes, chief assistant at Bristol, has taken the place of Mr. Woodward at Shrewsbury, while Mr. H. Reid goes to Bristol from the staff of the new works engineer.

Sir Herbert Walker and Major H. Holmes, the chief officers of the London and South Western Railway, and the staff and employees in the different departments, were referred to at the annual concert of the city staff in aid of the L. & S.W.R. Orphanage. Mr. G. T Hedge, who presided, said they achieved a wonderful performance in sending out the original Expeditionary Force, and but for the arrival of that force before the stipulated time, who could say what the enemy might not have accomplished.

Engineer and Railway Staff Corps.—The following appointments to the rank of Major were notified on January 1 :—Mr. C. J. Bowen Cooke, chief mechanical engineer, London and North Western Railway ; Mr. Henry Fowler, chief mechanical engineer, Midland Railway, Mr. J. Black, superintendent, North British Railway ; Mr. Gilbert S. Szlumper, assistant to General manager, London and South Western Railway and secretary of Railway Executive Committee. Mr. Szlumper was already a lieutenant in the Hampshire Fortress Engineers.

Mr. Vincent Raven, chief mechanical engineer, North Eastern Railway, is accomplishing excellent work as chief superintendent of the ordnance factories at Woolwich Arsenal, to which position he was appointed on September 20. Reporting to the House of Commons on December 20 on the work of the Ministry of Munitions, Mr. Lloyd George said that in the past Woolwich had been primarily responsible for the assembling of bodies and parts and for the filling of shells, and the dual responsibility unduly delayed matters. The War Office came to the conclusion about the end of August that it would be better to hand over that part of the operation to the Ministry of Munitions. Under the temporary management of the engineer of the North Eastern Railway the manufacture and output of articles for filling at Woolwich had increased in some cases by 60 per cent., and in other cases by 80 per cent., whereas the staff had increased by only 23 per cent. That was only one illustration of his work, which was having a potent effect on the cost and speed of the output.

TRAMWAY AND LIGHT RAILWAY NOTES

BOURNEMOUTH.

TRACK RECONSTRUCTION.

The Board of Trade are offering no objection to the Corporation borrowing £6,000 for the reconstruction of a portion of track between Bournemouth and Poole.

BIRMINGHAM.

TRACK RECONSTRUCTION AND REDUCED SPEED.—OVERTURNING OF A CAR.

The average speed of the Birmingham cars, including stoppages, is eight miles an hour, but where lengths of track are undergoing reconstruction speed for the journey from the city boundary to the centre of Birmingham has been reduced to six or seven miles per hour. Other factors contributing to this decision are the restricted lighting and the employment of many new motormen. At the adjourned inquest, on Dec. 15, on the three persons who died from injuries sustained through a tramcar getting beyond control and overturning at a curve, the jury returned a verdict of accidental death, and expressed their opinion that the motorman misjudged the distance for applying the brakes. At the Board of Trade inquiry the driver said he could not say why the brakes refused to act, unless there was an open circuit or a bad rail. The Inspector (Colonel Druitt) : It could not have been a bad rail with that heavy rain. Mr. R. H. Dickinson, rolling-stock engineer, said the brakes were tested after the accident and worked all right. The driver must have been going at too high a speed, and threw the magnetic brake right over, instead of notching it, and, there being no sand to use, that had the effect of picking up the wheels, which went over on to the roadway. At the speed at which the car was said to be travelling, it should have turned the curve if the wheels had been allowed to rotate. For the 40 weeks ended January 1, the car receipts show an increase of £81,504.

BRISTOL.

EMPLOYEES AND THE WAR.—MUNICIPAL TRAMWAYS PROJECT.

One thousand and thirty-nine of the employees of Bristol Tramways and Carriage Company had joined the colours up to December 5, and a large number in addition have registered under Lord Derby's scheme, and been placed in their groups. The Board of Trade have extended to October 31 next the period during which Bristol Corporation are entitled to give notice under Section 43 of the Tramways Act, 1870, of their intention to exercise the option vested in them of purchasing the Bristol Tramways undertaking.

HULL.

REDUCED LIGHTING AND ACCIDENTS.—REDUCTION OF SPEED.—OBSTRUCTION AT RAILWAY CROSSINGS.

Restricted lighting at Hull has resulted in an increase in the number of accident claims presented to the Tramways Committee. Representations have been made to the military authorities on behalf of the Tramways Committee and the traders. Through the medium of the Chief Constable the tramways manager has obtained permission to replace the small coloured route lights on the cars, but in consequence of the strain imposed on the motormen by the darkness speed has been reduced. The Tramways Committee have appointed a sub-committee for the purpose of endeavouring to secure a remedy for the delays to cars entailed by railway shunting over the level crossings. The Lord Mayor (Alderman Hargreaves) stated that the Board of Trade Regulations, made eight or ten years ago, were out of date, and were not applicable to the new railway methods of having trains made up of 70 or 80 trucks passing along so slowly that street traffic was held up for several minutes. Mr. McCombe, the manger, expressed the opinion there was shunting at the crossings that was illegal.

LEEDS.

INCREASED TRAFFIC.—APPLICATION BY EMPLOYEES.

During the 40 weeks ended January 1, the car receipts totalled £355,476, an increase of £27,149 on the corresponding period of 1914. The increasing call on the female population for munition and other workers has resulted in the cars being crowded morning and evening with women and girls. Many extra cars have had to be put on to enable them to reach the factories at 6 a.m. As workpeople's tickets are issued as late as 7.45 a.m., the majority of the workers

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are enabled to travel at a cheap rate. In common with other employees of the Corporation, the tramwaymen have asked for an addition to their bonus of from 2s. to 3s. a week, but while refusing the application the General Purposes Committee have offered to give facilities for working overtime.

LIVERPOOL.

GIFTS FOR TRAMWAY SOLDIERS.—SERVICE DIFFICULTIES.—BELL BOYS.

For the purpose of providing a Christmas gift for each of the tramwaymen serving with the forces, Liverpool Tramways Committee asked the Corporation to sanction the expenditure of a sum not exceeding £200. A member of the City Council has written to the chairman of the Tramways Committee, suggesting that during the present time of stress double the number of passengers should be permitted on each car. The Corporation allows nine standing passengers in the lower saloon, which brings the total number on a standard car up to 73. In an action in the County Court on December 16, brought in respect of injuries sustained by a passenger through the alleged negligence of a conductor, the jury expressed their opinion that a boy should be stationed on the cars to attend to the starting and stopping, as was the case in Manchester, so as to free the conductor. The "free and enlightened" twelve did not, however, indicate how boys are to be secured at the present time, or how the opposition of the unions is to be overcome. Rightly handled, the Manchester method enables an apprenticeship to car work to be instituted, but in most places the men oppose it because they desire to maintain a high rate of pay for unskilled labour into which many of them drift from other occupations.

MANCHESTER.

SANCTION TO DOUBLING.—WAR COLLECTIONS.—EXTENSIONS OF TIME FOR CONSTRUCTION.

Manchester Tramways Committee have received sanction from the Treasury for expenditure on street improvement and doubling of short lengths of tramways. The latest collection made on the tramcars was for the Serbian children, during the week ended December 25. The sum of £538 was received. Since August, 1914, over £17,000 has been collected on the cars, thanks to the indefatigable efforts of Mr. J. M. McElroy, the general manager, in stirring up the passengers by means of poster appeals. A contemporary, referring to his work, says:—"The figures are a tribute to the ingenuity of Mr. McElroy, who has himself devised each poster and is entirely responsible for the idea. Among war workers he has taken a high place, and all by virtue of attention to the halfpennies which other people had forgotten." The Board of Trade have extended for one year from August 18, 1916, the time given in the Corporation Act of 1911, for the completion of certain tramways.

PORTSMOUTH.

A SUCCESSFUL BONUS SYSTEM.—VOLUNTEER MOTORMEN.

For the three months ended September 30, the motormen and conductors earned bonuses amounting to £276, only one of the 200 men forfeiting the right to participate. The bonus was granted for immunity from accident, as usual, but in addition exceptional services were taken into consideration, as well as the extra hours that had been worked under conditions of abnormal strain and difficulty. In the case of an accident a man only forfeits his bonus when he is proved to be at fault. Seventeen volunteer motormen have been trained, and will work in shifts of not less than four hours.

SHEFFIELD.

PROSPECTIVE TRAFFIC ADDITION.—EMPLOYEES' WAR BONUS.—DISMISSED CONDUCTOR AND HOLIDAY PAY.

Large housing schemes are being put in hand in order to provide for men who are being introduced into the factories and works of Sheffield during the last few weeks of 1915 and the first two months of the present year. The influx should add still further to the great increase that has taken place in 1915-16 in the traffic receipts of tramways and omnibuses. The increase (£49,004 up to January 2) has been exceeded in only one other centre in England, namely, Birmingham. The Tramways Committee have agreed to recommend an increase in the war bonus now paid to their employees. It will involve a sum of £7,000 a year. Judge Benson in December reserved judgment in an action brought against the Corporation by a discharged conductor for wages in lieu of a week's holiday. For the Corporation the contention was advanced that they were entitled to exercise the right of dismissal without rendering themselves liable for a breach of contract or for payment of a week's wages in lieu of holiday. If the man was dismissed in proper form his right under the contract ceased.

YORK.

TRAIL CARS TO RELIEVE OVERCROWDING.

The tramways department have taken delivery of several trail cars that were recently ordered in order to relieve dangerous overcrowding. Certain alterations are being made at termini before the new vehicles are brought into use.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

16,770 Indicator for motor vehicles—E. Edwards and D. Richards.
16,779 Train signalling devices—P. Morgan.
16,836 Electro-magnetic driving or transmission gear—A. A. Canton.
16,920 Self-propelled vehicles—G. Watney.
16,961 Railway signals—J. G. Cruikshanks.
16,969 Arrangement for sensitively attaching or suspending under varying loads, axles, wheels, carriages, trams, body frames, seats, machines, and other devices particularly applicable to vehicles—E. B. Killen.
17,119 Covers for the seats of vehicles—H. P. Lake.
17,128 Electrically driven vehicles—British Thomson-Houston Company, Limited (*General Electric Co.*).
17,143 System of railway control—A. R. Craddock.
17,179 Means for indicating the direction of turning of motor cars and other vehicles—E. M. Blake and W. Tipler.
17,204 Metallic wheels for vehicles—W. J. Mellersh-Jackson (*Detroit Pressed Steel Company*).
17,205 Wheels of transport vehicles—W. S. Laycock, Limited, and T. Reid.
17,208 Metallic wheels for vehicles—W. J. Mellersh-Jackson (*Detroit Pressed Steel Company*).
17,261 Solid tires for road vehicles—P. D. Penn.
17,349 Electrical signalling devices—E. A. M. Reid and Callender's Cable and Construction Company, Limited.
17,361 Railway chairs for guard or other rails, points, and crossings—A. H. Laybourne (*S. T. Dutton*).
17,374 Trolley heads for electric tramways—R. H. Hollingsbee and W. H. Cottee.
17,419 Braking devices for electric motors—Maschinenfabrik Oerlikon.
17,565 Direction indicators for road vehicles—G. W. Crane and A. C. Yewdall.
17,575 Detachable wheels of motor road vehicles—T. F. Holloway.
17,602 Means for actuating tramway rail points—R. F. Larke.
17,642 Driving gear, particularly suitable for motor vehicles—F. H. Mingay.
17,652 Monorail systems—P. English.

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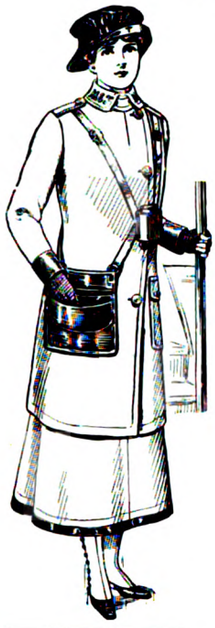

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17,691 Electric signalling — International Electric Company, Limited, H. E. R. Roose, and R. G. Le Noir.
17,697 Axles for motor cars—A. Abramson.
17,698 Passenger registers for vehicles—E. Priestman.
17,816 Metallic tire for motor cars—C. R. Sotomayer and C. F. Marcenaro.
17,836 Mechanical starter for motor cars—J. E. Hurst.
17,844 Starting and lighting sets for automobiles—British Thomson-Houston Company (*General Electric Company*).
17,879 Steering gear of motor vehicles—A. Thompson and R. Thompson.
17,923 Automatic train-stopping devices—A. L. Lyttle and C. I. Costello.
17,990 Mounting and swivelling the steering wheels of motor road vehicles—E. Quirk.

Specifications Published.

1914.

24,219 Anti-splash guards for motor vehicles—Hutchins.
22,251 Train control systems—Murray.
22,646 Jointing of rails by fishplates—Kerr.
24,190 Petrol engine bearings—Bradshaw.
20,244 Car lighting apparatus—Thomson.
21,561 Brake valve mechanism in connection with control systems of railways—Cowell and McCaughan.
22,893 Magnetic brakes, clutches, etc.—Newton and Newton Brothers (Derby), Limited.

1915.

10,132 Motor vehicle wheel—Dunham.
504 Driving and steering mechanisms for motor vehicles—Smith.
5,786 Lamps for motor vehicles—Dew.
6,820 Brake blocks for railway and tramway vehicles—Chaumont.
609 Mechanism for steering automobiles—Hazard.
4,557 Starting mechanism for motor cars—Fillettaz.
5,355 Double-decked vehicles—Spangler.
5,629 Electric signalling apparatus or indicators—Bobroff and Universal Indicator Company.
5,787 Lamps for motor vehicles—Dew.
5,931 Tire-making machines—Goodyear Tyre and Rubber Company.
10,957 and 10,958 Electric railway systems—Samuel, Slingo, Gunton, and others.
2,133 Brake gear mechanism for tramcars—Gibson and Gibson.
3,419 Electric signalling systems—Stern.
4,531 Road vehicle wheels—Cope and Warland Dual Rim Company.
7,754 Process of and apparatus for sanding rails—Geraghty.
8,376 Safety device for use with electrically-driven vehicles—Turner.
10,366 Fish-joints—Johnsen and Johnsen.
11,707 Motor vehicles—Scott.
12,194 Lifting jacks—Mellersh-Jackson (*American Chain Co.*)

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1914. WEEKS ENDED. Dec. 5.	Dec. 12.	Dec. 19.	Dec. 26.	1915. WEEKS ENDED. Dec. 4.	Dec. 11.	Dec. 18.	Dec. 25.	AGGREGATE. Wks.	1915.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	52,716	52,112	51,634	52,765	51,954	54,110	51,874	52,156	51	2,607,179	−133,550
Auckland	...	(28 days)	20,414	...	...	(28 days)	21,804	...	24	125,840	+ 908
Burma Rs.	3,595	3,353	3,195	3,115	3,611	3,605	3,551	3,506	...	74,963	+ 6,579
Calcutta Rs.	63,057	62,189	62,547	62,574	67,400	66,940	67,012	67,838	51	3,361,496	− 29,738
Hong Kong $	...	...	...	...	...	...	...	...	...	...	...
Madras Rs.	(14 days)	24,471	(14 days)	31,416	(14 days)	28,666	(14 days)	36,150	50	708,977	+ 42,356

Companies Issuing Monthly Statements.

	1914. July.	August.	Sept.	October.	Nov.	December	1915. July.	August.	Sept.	October.	Nov.	December	Wks.	AGGREGATE. 1915.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Brazilian Street Mlrs.	...	...	...	...	...	...	...	...	...	...	...	...	...	—	—
BrazilianTraction Mlrs	6,462,860	6,166,100	6,096,940	6241170	5929730	...	6,703,000	6,576,000	6,494,000	6793000	6336000	...	48	70,586,110	+3,245,122
Brisbane	29,680	33,172	28,031	28,763	...	...	31,150	35,064	30,360	31,880	...	...	44	306,954	+ 18,333
British Columbia $	690,023	674,812	650,516	661,000	648,485	...	510,723	507,126	517,022	538,826	562,782	...	22	2,636,479	− 688,357
Buenos Aires Pt. & C.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Buenos Ayres Lacroze	43,328	40,508	40,333	42,341	42,256	44,000	41,460	41,468	39,355	42,516	42,603	43,528	26	250,930	− 1,836
Cape Town	...	...	...	...	...	...	13,960	...	13,310	...	13,870	...	—	—	—
Carthagena& Herrerias	2,416	2,758	2,175	1,543	1,379	1,255	2,157	1,523	1,252	2,169	2,090	2,129	52	21,968	− 3,354
Cordoba	14,165	13,371	12,384	12,904	12,468	...	14,373	14,157	13,213	13,433	13,785	...	30	111,123	+ 3,784
East India	2,045	2,112	1,980	2,007	2,029	1,839	2,231	2,266	2,054	2,069	2,065	2,062	22	10,516	+ 549
Kalgoorlie	2,552	3,042	2,864	2,525	...	...	2,775	3,165	2,997	2,675	...	...	44	27,791	+ 1,286
La Plata	4,358	4,060	3,598	4,540	4,540	4,452	4,055	4,165	3,894	4,405	4,545	4,564	52	51,400	− 3,984
Lima	34,627	29,898	28,717	30,646	29,712	...	33,344	32,011	30,543	32,208	30,703	...	48	351,169	− 9,612
Manila $	133,900	128,500	116,300	125,750	129,000	...	123,750	126,650	123,946	124,131	129,447	...	48	1,353,983	− 116,711
Melbourne	...	...	..	...	...	...	63,432	...	...	...	...	...	—	—	—
Mexico $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Montevideo	26,417	26,075	25,226	26,500	27,081	28,605	25,161	26,493	25,070	27,167	28,407	31,305	8	59,712	+ 4,026
Port Elizabeth	...	...	...	...	...	...	3,362	...	2,927	...	3,110	...	—	—	—
Puebla $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Rangoon	4,975	4,629	4,119	4,600	4,405	4,459	4,629	4,510	4,445	4,886	5,028	4,492	52	57,735	− 1,786
Toronto $	866,221	850,639	879,321	849,636	824,634	...	773,013	762,627	804,902	792,001	851,113	...	48	8,793,719	− 502,658
Winnipeg $	346,630	322,762	310,996	330,562	330,398	...	248,022	251,189	261,982	286,146	323,025	...	48	3,122,620	− 610,281

(*Continued on page 64*)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1914. WEEKS ENDED.				1915. WEEKS ENDED.				AGGREGATE.			
	Dec. 5	Dec. 12	Dec. 19	Dec. 26	Dec. 4	Dec. 11	Dec. 18	Dec. 25	Wks.	1915.	Increase or Decrease.	
	£	£	£	£	£	£	£	£		£		£
Aberdeen Corporation	1.551	1.610	1.517	1.551	1.714	1.656	1.670	1.709	29	1.709	+	158
Accrington Corporation	464	456	446	504	498	500	521	551	38	21.132	+	545
Ayr Corporation	227	218	221	220	230	234	237	256	32	12.787	+	711
Bath Electric	*	...	...	...	...	...	...	...	...	—		—
Birkenhead Corporation	1.251	1.219	1.264	1.255	1.284	1.378	1.378	1.422	38½	53.203	+	4.282
Birmingham Corporation	12.385	12.214	12.759	12.580	14.707	15.850	15.600	14.525	39	550.504	+	78.449
Blackburn Corporation	1.047	980	1.036	1.061	1.012	1.017	1.026	1.128	39	49.568	-	216
Blackpool and Fleetwood	314	263	270	355	267	244	259	316	51	38.628	-	390
Blackpool Corporation	666	573	540	649	598	656	641	689	39	68.094	+	1.721
Bolton Corporation	2.397	2.416	2.442	2.726	2.426	2.554	2.606	2.772	39	104.018	-	1.533
Bournemouth Corporation	1.643	1.741	1.849	1.867	1.717	1.701	1.904	2.037	39	83.754	+	3.876
Bradford Corporation	5.538	5.933	5.667	6.258	5.622	5.746	6.530	6.045	38	251.258	+	10.165
Brighton Corporation	833	812	830	914	837	875	850	954	38½	43.909	+	379
Bristol	8.460	7.920	8.461	9.715	9.776	10.023	10.122	12.698	51½	493.794	+	53.713
Burnley Corporation	1.336	1.303	1.352	1.656	1.438	1.499	1.526	1.700	39	62.051	+	1.399
Burton-on-Trent Corporation	285	264	271	308	269	293	271	315	39	11.013	-	403
Bury Corporation	1.127	1.126	1.133	1.295	1.144	1.182	1.216	1.320	38½	52.525	-	390
Cardiff Corporation	2.483	2.418	2.565	2.676	2.450	2.594	2.578	2.768	38	104.120	-	2.478
Chatham and District	974	987	971	1.087	981	1.016	1.039	1.139	51	59.056	+	9.586
Chesterfield Corporation	256	243	242	308	243	251	262	273	38	10.337	-	25
Colne Corporation	206	203	211	...	213	223	225	...	...	—		—
Cork Electric	450	424	450	530	439	451	432	496	51	25.457	-	10
Croydon Corporation	1.528	1.564	1.627	1.876	1.506	1.635	1.690	2.009	38	70.859	+	4.437
Derby Corporation	911	901	942	990	950	1.016	988	1.015	38½	40.506	+	1.285
Dover Corporation	220	229	230	238	263	276	267	256	38	12.115	+	2.142
Dublin and Lucan	121	106	114	283	114	99	105	276	25	3.868	+	59
Dublin United	5.717	5.495	5.850	6.375	5.624	5.755	5.714	6.938	51	311.437	+	11.072
Dundee City	1.224	1.239	1.216	1.245	1.280	1.264	1.264	1.331	31½	43.122	+	2.297
East Ham Corporation	1.215	1.202	1.211	1.402	1.232	1.325	1.339	1.359	38½	50.319	+	5.394
Exeter Corporation	318	306	316	337	306	324	321	392	38	14.647	+	846
Gearless Motor Buses	*	...	...	...	...	...	...	...	...	—		—
Glasgow Corporation	19.904	20.147	20.093	20.257	20.997	21.013	21.807	22.290	30	646.360	+	46.139
Glasgow Subway	1.064	1.073	1.102	1.101	1.233	1.247	1.276	1.246	51	55.033	+	2.200
Glossop (Urban Elec. Supply Co.)	94	97	101	113	118	127	123	132	52	6.522	+	328
Halifax Corporation	1.942	1.851	1.831	1.982	1.895	1.812	1.799	2.010	38	85.100	+	908
Hastings and District	683	724	757	784	667	678	721	849	51	69.283	-	200
Huddersfield Corporation	2.294	2.270	2.281	2.668	2.317	2.385	2.437	2.637	38	103.241	+	14.342
Hull Corporation	3.002	2.898	3.031	3.095	3.121	3.252	3.176	3.217	38	118.322	-	2.303
Ilford U.D. Council	587	593	595	655	577	614	616	656	38	25.004	+	2.894
Ilkeston Corporation	113	111	120	123	129	128	128	144	39	5.270	+	214
Ipswich Corporation	383	384	398	451	441	476	466	499	37	21.264	+	3.400
Isle of Thanet	263	265	181	307	202	236	217	258	12	3.159	-	968
Kilmarnock Corporation	148	148	144	149	149	149	153	162	32	5.390	+	171
Lanarkshire	1.651	1.699	1.673	1.726	1.901	1.862	2.007	1.984	51	100.948	+	6.067
Lancashire United	1.469	1.443	1.459	1.502	1.451	1.482	1.519	1.546	51	87.875	+	5.265
Leeds City	7.919	8.020	8.003	8.715	8.202	8.483	8.641	8.996	39	345.961	+	26.002
Leicester Corporation	2.786	2.799	2.873	2.936	3.037	3.241	3.137	3.258	52	156.661	+	9.621
Leith Corporation	647	653	627	668	695	698	706	749	32	24.648	+	1.577
Leyton U. D. Council	1.377	1.384	1.323	1.588	1.401	1.493	1.521	1.627	38	61.989	+	9.120
Liverpool Corporation	12.641	12.446	12.907	13.225	12.671	13.382	13.625	14.283	51	684.156	+	11.804
Llandudno and Colwyn Bay	...	156	159	179	...	168	173	204	3½	628	+	40
London County Council	*	...	...	...	...	...	...	...	...	—		—
London General Omnibus	*	...	...	...	...	...	...	...	...	—		—
London United	*	...	...	...	...	...	...	...	...	—		—
Lowestoft Corporation	177	170	166	127	133	131	123	167	12½	2.212	-	640
Maidstone Corporation	160	162	160	206	170	180	186	204	38	8.446	+	254
Manchester Corporation	16.351	16.442	17.061	16.568	16.559	17.289	17.709	17.467	38	689.289	+	21.732
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	...	—		—
National Steam Car	*	...	...	...	...	...	...	...	...	—		—
Nelson Corporation	150	136	144	192	168	181	174	188	38½	7.527	+	296
Newcastle-on-Tyne Corporation	5.814	5.624	5.864	6.307	5.609	5.724	5.779	5.920	38	241.754	+	27.907
Newport (Mon.) Corporation	744	737	737	735	793	849	818	856	39	32.436	+	731
New St. Helens and District	810	854	836	870	834	892	906	929	25	26.249	+	2.646
Northampton Corporation	609	563	592	624	591	652	631	794	38½	28.032	+	4.918
Nottingham Corporation	3.217	3.148	3.211	3.682	3.397	3.619	3.580	3.804	38	142.936	+	10.060
Oldham Corporation	1.915	1.938	1.950	2.246	2.022	2.093	2.131	1.978	40	90.710	+	3.640
Portsmouth Corporation	2.040	2.003	2.089	1.905	1.947	2.030	2.104	1.994	39	96.948		—
Preston Corporation	851	839	806	916	910	977	1.000	1.007	38	37.003	+	1.476
Provincial	1.873	1.773	1.840	2.025	1.867	1.998	2.028	2.041	12½	25.123	+	1.409
Reading Corporation	653	656	671	815	699	786	775	867	38	30.461	+	3.179
Rhondda Tramways	1.097	1.066	1.085	1.110	1.099	1.140	1.150	1.201	51	60.238	-	1.942
Rochdale Corporation	1.401	1.401	1.448	1.713	1.418	1.526	1.542	1.659	37½	65.869	+	2.832
Rotherham Corporation	945	948	971	1.219	1.162	1.199	1.216	1.306	39	45.876	+	5.445
Salford Corporation	4.585	4.629	4.762	4.761	4.759	4.923	5.133	5.193	38½	201.627	+	4.876
Sheffield Corporation	7.676	7.779	8.058	8.609	9.029	9.400	9.418	8.830	39½	354.247	+	48.173
Southampton Corporation	1.210	1.236	1.239	1.364	1.334	1.409	1.416	1.541	38	57.650	+	6.279
Southend-on-Sea Corporation	629	615	617	695	532	579	587	623	38	31.979	-	8.007
South Metropolitan Tramways	*	...	...	...	...	...	...	...	...	—		—
South Shields Corporation	696	665	698	773	707	737	728	806	38½	30.792	+	1.230
Sunderland Corporation	1.357	1.314	1.366	1.553	1.460	1.525	1.472	1.625	39	58.337	+	739
Sunderland District	519	506	572	552	535	510	449	543	8	4.304	+	271
Swindon Corporation	171	168	173	192	160	175	179	196	38	7.533	+	647
Torquay Tramways	347	338	375	388	341	363	386	410	51	27.471	-	398
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	...	—		—
Tyneside Tramways and Tramroads	515	517	492	534	474	467	479	505	28	14.925	-	664
Wallasey Corporation	1.073	1.033	1.066	1.087	1.084	1.136	1.144	1.182	38½	49.727	+	739
Walsall Corporation	673	651	679	797	725	809	784	881	52	38.533	+	5.702
Walthamstow U.D. Council	724	709	720	770	704	758	750	806	39	34.915	+	3.355
Warrington Corporation	438	434	439	515	458	484	469	505	38	17.584	+	836
West Ham Corporation	2.720	2.793	2.777	3.214	2.808	2.938	3.006	3.280	38	118.835	+	10.093
Wigan Corporation	1.398	1.349	1.410	1.679	1.416	1.493	1.536	1.625	38	58.749	+	2.706
Wolverhampton Corporation	1.006	1.022	1.150	1.158	1.129	1.155	1.174	1.373	39	43.995	+	2.484
Yorkshire (West Riding)	1.316	1.312	1.325	1.728	1.372	1.610	1.460	1.726	52	81.929	+	6.654

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officals and the principal particulars relating to each undertaking.

THE TRAMWAY AND RAILWAY WORLD

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If any readers are under the impression that industrial motor manufacturers are in an enviable position and are doing very well indeed out of the war, it is time that they disabused themselves. At the moment, no doubt, satisfactory profits are in general being made, though it is questionable whether in more than a very few instances these profits are any greater than they would have been had a continuance of business permitted of normal development. We are concerned here with a very young industry, which has only recently passed from the stage of trial and experiment to the assured position that it now occupies. Had the industry been half a century old, and had the change to motor transport been complete and the demand for motors consequently depended only on the need of renewing old stock, the profits would have been fairly steady from year to year. The terms upon which business is done with the Government are strictly reasonable, and under the conditions postulated the result might have been a maintenance of profits, but certainly would have shown little or nothing in the way of excess profits. As things are, the growth of the industry and the expansion of output has proceeded. The capital involved has increased, and the profits have increased with it. Consequently the great majority of the firms engaged in this industry become liable to taxation of what appears to be a substantial excess profit. There is general agreement as to the difficulty of taxing excess profits in an equitable manner, but it is very hard to see how, if the matter is fully considered, there can be any less agreement upon the fact that a young industry under existing arrangements tends to suffer much more severely by taxation than an old one. This is rather unfortunate, since the young industry has not the same support of accumulated funds and prestige, and is less able to bear with impunity a temporary setback. A state of growth in business involves steadily increasing expenditure, and if profits are not allowed to increase appreciably, the whole position becomes very difficult. Particularly is this so when, as in the present instance, the goodwill resulting from past years of honest trading is caused to pass out of the hands of its owners, and to be diverted in the direction of foreign competitors. In the industrial motor industry goodwill is of exceptional importance, inasmuch as the majority of users avoid whenever possible any tendency to accumulate mixed fleets. Consequently if—under the stress of necessity rather than choice—such users, deprived at the outbreak of war of their British machines, and unable to fill the gaps from the same sources, purchase foreign cars, they are thereby given a bias in favour of continuing to increase their fleets by adding yet more foreign vehicles of the same make. To recover goodwill under these difficult circumstances, the British industry will find it necessary to spend money freely, more particularly in connection with the enlargement of sales departments. This is where any unduly severe taxation of profits made during the war would fall very hard.

* * * * * *

The whole of the future position is further complicated by at least one circumstance, in respect of which commercial motor manufacturers are in a unique position. In general, munitions of war are required for immediate and special use, and after use either cease to be of value or at any rate are not in any general demand. The only weapon that returns to the man who throws it is the boomerang, and so far as we are aware this is one of the few implements of war in the renewed or novel use of which the Germans have not set the fashion. Shells, torpedos, and the like do their work and then cease to exist as such. Big guns, and even military rifles, are never likely to be wanted in quantity by the general public. Motor lorries, on the other hand, if well constructed, remain fit for service for a long period. Moreover, the military type is not inherently unsuitable for civilian use. Thus it will inevitably happen that at the termination of war large numbers of second-hand machines will return to this country. We do not as yet know definitely what will be the next step, but it is fairly safe to assume that they will be sold by public auction. This, no doubt, will happen just at a time when manufacturers are having their work cut out to dispose of their much increased outputs of new machines, and herein lies a grave danger to the stability of the whole industry. Meanwhile, it is very doubtful whether the user will ultimately prove a gainer by the transaction. He may get cars at a low price, but it is a questionable matter what service they will give him. Some few no doubt will be in excellent condition, having by chance escaped any very severe work. Others, apparently quite sound, will doubtless have been subjected to reckless handling or rough use, resulting in internal troubles very difficult to detect by the running of the vehicles, or even by careful examination. There will be a very decided element of uncertainty about the quality of these second-hand lorries. Some will succeed ; others will prove total failures. As we have already stated,

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MOTOR TRAFFIC.

the policy of users who decide to purchase these machines will be of doubtful soundness. Incidentally, when things go wrong, manufacturers will probably be quite unjustly blamed. A car may be of first-class construction and design, and yet may have been ruined as a dependable vehicle in the course of a very few months or even weeks of military work. All this constitutes a complication against which manufacturers will have to provide freely, and whether such provision is possible appears to depend largely on the treatment that is meted out to them by those responsible for the assessment of taxation.

* * * * * *

It would be a great thing if some scheme could be devised under which the sale of second-hand vehicles by Government would be regulated. In Germany an arrangement of this kind has already been made, and the army cars will not be thrown upon the market in bulk, but gradually, in lots not so large as seriously to incommode the business of manufacturers. The German method could be improved upon if some scheme could also be embodied under which all the second-hand cars would be thoroughly overhauled before being put upon the market. Were this done, the user would be reasonably safeguarded, and better prices would consequently be paid. The manufacturer, too, would at least in some measure escape the risk of being condemned as a result of the indifferent performance of vehicles originally emanating from his works, but long since passed out of his control.

* * * * * *

Municipal authorities and private traders are alike interested in the rapid development of the use of the electric battery vehicle that has taken place during the past year. Its progress has been attended by the most fortuitous circumstances, and British users and prospective purchasers are most favourably circumstanced in that the movement was initiated by the Municipal Electrical Association. It has been continued under the auspices of the Electric Vehicle Committee of that Association, and, together with their secretary—the indefatigable electrical engineer and tramways manager of Ipswich—every member gives his services in an honorary capacity. Before the outbreak of the war the committee had been in existence only a year, and little propaganda work was undertaken beyond the reading of papers and an exhibition of vehicles. Yet 150 electrics, mostly Edison machines, were working at the end of the twelve months. The war gave the committee and the makers an opportunity of which they have fully taken advantage, and with a year of British practice to guide them, to say nothing of the data available from the United States for several years past, the manufacturers may look back upon the year 1915 with much satisfaction. Particulars for the complete year are not yet available, but up to the end of November the number of machines on the road was 660, the total having thus been quadrupled. Every electric vehicle placed in service has been the means of rendering service in regard to the war. The use of the electrical vehicle, too, has averted extravagant outlays on horses, to say nothing of the saving of time and labour. The two latter factors will become of increasing importance the longer the war lasts. For several months labour has been inadequate in almost every direction. In this aspect of their use electrics have the advantage that a horse-driver can very quickly be trained to manipulate the battery-propelled car, truck, or omnibus.

* * * * * *

American progress in battery or petrol vehicle traction, as far as our information extends, cannot show such rapidity for any year as the past year has effected in this country. A recent announcement of the General Vehicle Company, New York, reminds us that the first practical petrol automobile in the United States was built about 1886, and the first real electric truck fifteen years later, but for neither was there a great demand until 1909. In that year, although battery vehicles were negligible in number in Great Britain, the petrol machine had invaded practically every sphere open to it. The General Vehicle Company adds that their vehicles have demonstrated over ten years' life in hundreds of cases, and have traversed as much as 21,000 miles each per year, proving efficient in hilly cities like Pittsburgh and Cincinnati. Further, they state that each good electric sold eventually sells two more. Recommendation has clearly proved a considerable factor in effecting sales on this side of the Atlantic, and will become increasingly effective during the next few years. The latest development in the United States is the battery exchange system, which has been introduced to power-stations by the Edison Storage Battery Company, New Jersey, as a means of doubling their vehicle load in a few months. Municipal electricity departments in Great Britain possibly might require to obtain legislative sanction before adopting the exchange system, but there is no reason why company undertakings should not experiment with it. In towns where a parcels delivery is worked by the tramways department, a new sphere might be opened up for the light electric vehicle. In several places the increase in the parcels traffic has led to the purchase of motor cars. At Cardiff, Mr. Ellis has stated that great developments might have been made at Christmas with relays of motor cars for collection and delivery. Mr. Ellis is also the city's electrical engineer, and he would therefore be able to find scope for an electric vehicle in the power and lighting department when not required for parcels work. We hope that his committee may be persuaded to make the first provincial experiment in a direction in which electric vehicles are used by railway companies and private firms in London.

ERITH COUNCIL TO RUN OMNIBUSES.

Application has been made by Erith Urban Council to the Board of Trade for a Provisional Order to amend their Tramways Act to enable them to run motor omnibuses inside and outside of the Council's district. An intimation that no objection will be raised by the Board of Trade has been received, and as neighbouring authorities are favourable to the innovation, the tramways department will be able to institute a service as soon as the vehicles can be obtained. Additional means of conveyance are greatly needed in this district of Kent, which is mainly an industrial locality, where war work is in progress. One large firm have for some time been running motor vehicles of their own in order to convey the employees to and from their work. The Erith Council's tramcars run up to the London County Council's system at Abbey Wood, and south of Erith there is the Bexley Urban Council's tramways.

It is understood that Bexley Council are applying for similar powers. No other metropolitan authority has obtained powers to run omnibuses, but a year ago the matter was under discussion at Croydon. Woolwich Council's assent to the Erith application to run the vehicles inside the former district was given subject to their right to make the sanction on such conditions as they might think fit to impose.

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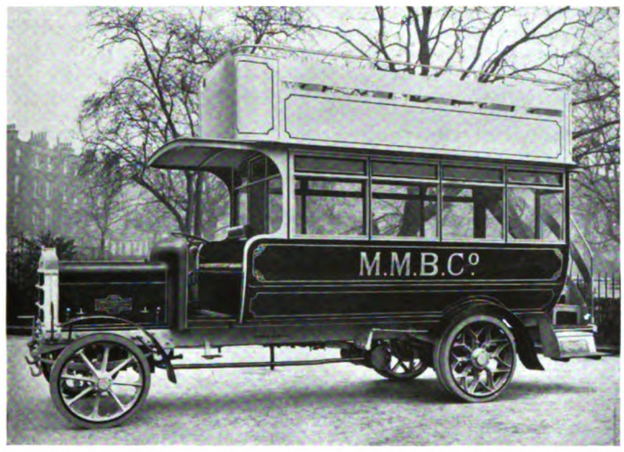
MOTOR TRAFFIC.

STRAKER-SQUIRE NEW TYPE OMNIBUS.

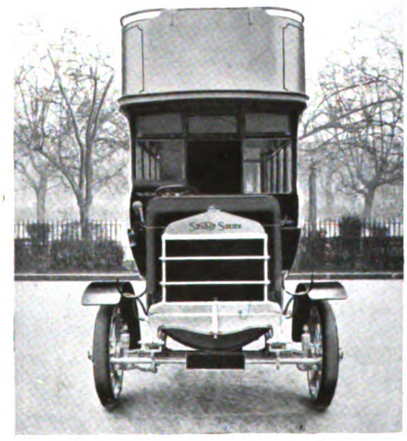
The illustrations on this page show a new type of omnibus, a number of which Straker-Squire, Limited, of Nelson Square, Blackfriars, are supplying to the Midland Motor-Bus Company, of Wolverhampton. The chassis is the company's C.O.5 model, designed to carry a load of four tons, excluding the body. This is fitted with a 4-cylinder engine, cylinders cast in pairs, 120 mm. bore and 140 mm. stroke, developing 45 H.P. It is well suited for public service vehicles, is thoroughly reliable, and embodies all the improvements in detail that Messrs. Straker-Squire's long experience with industrial motors have found advisable.



Straker-Squire New Type Omnibus.

Examination of this chassis will reveal its remarkably simple arrangement and accessibility of all working parts. Thus one section can be taken down and removed without interfering with other parts of the chassis, and all parts subjected to exceptional wear or stress quickly and easily replaced. Further, the specification gives evidence of a studious selection of materials, and the careful treatment of these in the manufacture of the small fitments upon which so much depends where a regular service is required.

A new design is utilised for the body. This is constructed to seat 33 passengers. Messrs. E. and H. Hora, of Peckham Road, London, S.E., are the builders. It is constructed throughout with best seasoned timber, with oak and ash framing, mahogany panels glued and canvassed. The side panels are brought right down to the bottom framing, and are carried through the entire length of body, with small arches cut out for the hind wheels. As all the corners are rounded, it will be seen that the body has a very handsome appearance.



The inside seating is arranged partly transverse and partly longitudinal. There are three rows of transverse seats at the front end, double seats on the offside, and single seats on the nearside, both of the garden type. Behind these on each side is a longitudinal seat to take three persons.

The interior is upholstered in Terry velvet, with spring cushions to every seat, and spring squabs to the longitudinal seats, with plain stuffed squabs to the transverse or garden seats. The inside is finished off in three-ply wood polished natural colour, and capped with oak mouldings and mahogany garnish rails, the backs of seats also being polished to match the panelling. The windows are of 3/16th polished plate glass, which is bedded in with rubber and fixed with hard wood slats. Above these windows are folding ventilators with side springs to prevent any of the vibration that previously has always been a cause of annoyance. The frames of these ventilators are of mahogany stained and polished.

As the trap door over the gear box is extra large, and comes underneath the legs of the garden seats, arrangements are made for the legs of such seats to hinge and fold up underneath the seat board. The top deck is constructed with rounded front corners, which is in keeping with the general design of the body, and seats 18 passengers.

The usual entrance platform is provided at the rear for the conductor and, as will be seen from the illustration, there is ample space for the passing of passengers both to the interior and the top deck. Close brass-plated commode handles and brass staircase rail are fitted. The body is mounted on chassis on shallow runners and provided with sets of wooden mudguards and forged mild steel stay irons.

OLDHAM CORPORATION OMNIBUSES.

Mr. J. W. Dugdale, general manager, Oldham Corporation Tramways, in his report on the working of the department during the year ended March 31, 1915, gives the following particulars of the two years' working of the three motor omnibuses owned by the tramways department :—

	1915.	1914.
Total borrowing powers ...	£7,200	£7,200
Borrowing powers exercised	£2,500	£2,500
Gross capital expenditure...	£2,640	£2,640
Traffic revenue	£1,301	£1,278
Total revenue	£1,349	£1,342
Working expenses	£1,800	£1,616
Interest (less tax)	£84	£13
Paid to sinking fund ...	£480	—
Net balance (deficiency) ...	£1,015	£805
Miles run	31,899	29,010
Passengers	289,555	304,563
Ratio of working expenses	133·43	122·05
Average revenue per mile	10·15d.	10·958d.
Average expenses per mile	13·548d.	13·37d.
Average fare	1·08d.	1·074d.
Number of omnibuses ...	3	3
Total sinking fund ...	£480	—

The deficiency of £1,015 has been transferred to the tramways reserve fund. Two services have been maintained, the fare stages being a penny and three-halfpence, the latter being for the full journey from the Town Hall to College Road. The service between the tramway terminus at Grain's Bar to Denshaw was opened on August 31, 1914, and "has proved very convenient to the residents of the district and to visitors generally." The Grains Bar tramway service was opened on June 4, 1914, so that one of the omnibus services has proved of value as a feeder.

A Bowser petrol storage tank for the use of the petrol vehicles belonging to the department has been fixed adjacent to the garage in Copsterhill Road. During the past year the motor tower-wagon has attended to 387 emergency calls.

MOTOR AMBULANCES.—The accounts of the British Red Cross Society and the St. John Ambulance Association for the year ended October 31 show that there were 897 motor ambulances at work at the various fronts ; £615,963 had been expended on those vehicles. The number is constantly being added to.

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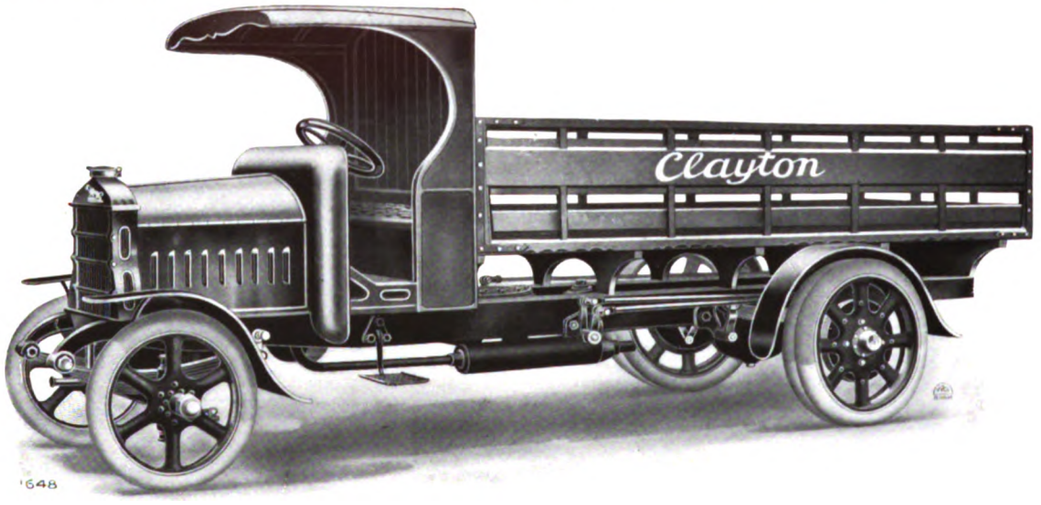
MOTOR TRAFFIC.

CLAYTON & SHUTTLEWORTH'S 3-4 TON PETROL CHASSIS.

The traction novelty at the Smithfield Club's Show at the Agricultural Hall, London, this year was the new 3 to 4-ton petrol chassis exhibited by Messrs. Clayton and Shuttleworth, of Stamp End Works, Lincoln. It has been known for some time that this prominent firm of steam vehicle builders were turning attention to petrol machines, but manufacturing difficulties due to the war considerably delayed their plans. As will be seen from the illustration, the chassis was shown complete with a lorry body. It presented a very neat appearance, and at the same time looked of sturdy construction.

The engine is of the vertical 4-cylinder type, cast in pairs 120 mm. by 140 mm., giving approximately 45 B.H.P. at 1,000 revolutions per minute. The water jacket provides an abundant supply of water round the combustion chamber, valves, and cylinders, and is of sufficient length, so that the pistons do not at any part of the stroke pass below it. The base chamber is of cast iron, and the bottom cover containing the main bearing is of aluminium. Gun metal lined with anti-friction alloy is used for the bearings. Large inspection openings fitted with oil-tight covers are provided in the side of the casing. All the valves are placed on the left side of the engine; these are of nickel steel and are operated by one cam shaft.



New 3-4-ton Petrol Chassis by Clayton & Shuttleworth.

Special attention has been given to the method of driving the cam shaft and the shaft serving the magneto, in order to ensure silent running and accessibility. The crank shaft is of oil-tempered steel, specially selected for its resisting power against fatigue, and large bearing surfaces are provided. The speed of the engine is controlled by means of a lever worked on a rack quadrant attached to the dashboard, operating on the throttle valve, the spark advance lever being fixed to the steering column. An accelerator pedal is also provided, acting on the throttle for the more rapid adjustments of speed called for when travelling in traffic. High-tension magneto ignition is fitted, the magneto being readily accessible and worked by the lay shaft through a claw coupling. The Claudel Hobson carburettor is fitted.

The radiator is of the straight tube type, with removable top and bottom, the water pipes being large and arranged to give effective cooling by natural circulation. Lubrication is effected by means of an oil pump driven by skew gearing from the cam shaft, the oil being delivered through service pipes to all the engine bearings. The oil pressure gauge fixed on the dash indicates the pressure of oil and also shows whether the pump is working properly.

There is a cone pattern clutch, made in aluminium and shod with "Ferodo." Between the clutch and the gear box a leather disc form of universal coupling is fitted, thus preventing undue strains when travelling over rough roads. The change speed gear box is of aluminium, arranged for four changes of speed in forward direction and one reverse. It is fitted with ball bearings throughout, the change being made by levers on the gate principle.

The worm drive reduction gear axle is of the full floating type. The road wheels, fitted with plain floating gun-metal bushes, are mounted and revolve on the tubular part of the fixed load-carrying axle. This consists of a tubular section steel stamping, passing underneath and supporting the gear casing. The driving shafts pass through the tubular portion of the dead axle, and have flanges secured to their outer ends that transmit the drive to the road wheels. Thus there is no load carried on either the axle casing or the driving wheels. The drive is transmitted from the propeller shaft by means of a worm and worm wheel to the differential casing. A large inspection cover at the bottom of this casing enables the whole of the gear to be removed without disturbing the rear axle.

A straight steel forging of H section is used for the front axle, with large bearing surfaces for the wheel hubs. The steering levers are of very ample proportions and the coupling rods are fitted with spring loaded caps. The wheels are of the Clayton all-steel pattern, the front 33 in. in diameter and the rear 40 in. diameter, gun-metal floating bushes being fitted to each. Two double-acting brakes are fitted, both operating on the road wheels. These are of the internal expanding type, actuated by a hand lever in one case and a pedal in the other, the brake shoes being all lined with "Ferodo."

Exhaustive trials have been carried out with this vehicle. On each occasion most satisfactory results were obtained. Directly the company are released from their munitions contracts, arrangements will be made to produce the chassis on a large scale.

FODEN STEAM WAGONS IN FRANCE.

A driver in the mechanical transport of the Army Service Corps has sent the following letter to Fodens, Limited, of Sandbach, Cheshire, the builders of the Foden steam wagons:—

"I have been driving one of your 5-ton wagons for eight months. I was in Antwerp and Ostend, also at Locane, Kamel, and Ypres. I find your wagons never fail. The wagon I have been driving has been pulling 19 tons; when I say 19 tons I expect you hardly believe it, but it is quite true. It has been pulling a 6-in. gun, the weight of which is 14 tons, and the wagon also had 5 tons of shells, so that made it just the 19 tons. Another thing about one of your 3-ton wagons. I went fifteen miles one night 'somewhere in France' to pull a 4·7 gun from a ditch; the gun weighed 8 tons. When I got to the place the captain said, 'That engine is no good; I want a traction. You will never get that gun out with that little thing.' I got out and had a look, but after I had had a good look I asked for a chain out of my wagon, which I fastened on to the gun, ran the wagon back, coupled up to the gun, then I got up in the wagon, changed into slow speed, also used double high pressure gear, and a full head of steam, and, to the captain's surprise, the little wagon flew out with the gun."

Omnibuses for Estate Development.—In the absence of railway facilities, the motor omnibus is aiding the development of an estate between Brighton and Newhaven. The South Coast Land and Resort Company announce that there is a half-hourly service running during the season, both from Brighton and Newhaven.

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MOTOR TRAFFIC.

EDISON ACCUMULATOR CHASSIS.

STANDARDISED MODELS FROM 10 CWT. TO 6 TONS.

That Edison Accumulators, Limited, of Duke Street, Piccadilly, London, have made the most of the exceptional opportunity presented to the electric vehicle by the war is shown by the latest figures issued by the Electric Vehicle Committee. At the end of November the total number of electric conveyances in use was over 660, as compared with 150 twelve months before. The list of users reveals that the great majority of the chassis were supplied by Edison Accumulators, Limited, who executed orders ranging from the runabout to 6-ton automatic tipping wagons. Every variety of use is embraced by the intermediate vehicles, from the 58 light vans of Harrods', Limited, to the omnibuses supplied to York, Southend, South Shields, and West Bromwich Corporations, and Brighton and Loughborough Omnibus Companies. Over fifty are run by five railway companies. Three tramway authorities are using tower wagons, and there is a long list of municipal and electric supply authorities, besides munitions factories and steel and metal works.

Delivery has been made with expedition, and it is becoming increasingly prompt. This is due in a large measure to the standardisation of the G.M. model, every part having been proved a practical success from the standpoint of reliability, whilst the whole gives low operating cost. Two of our illustrations show the elevation and plan view of the 2-ton specimen of this model.

An important consideration is the guarantees that are given. The chassis is warranted for one year against defects due to faulty material or workmanship. Provided the cells be operated and cared for according to the standard instructions, all Edison accumulators are guaranteed to maintain 100 per cent. of their rated capacity for a period of four years from the date of sale, irrespective of the mileage. As regards solid tires, 12,000 miles of satisfactory service is assured provided the vehicle is not overloaded.

Every variety of use is embraced by the light loading capacities of the G.M. model available, viz., 10, 20, and 30 cwt., and 2 to 6 tons. Within those weights there are 24 distinct patterns. There are three separate frame lengths and wheel bases for each load rating. A short, medium, or long body may be chosen for any contemplated service, thus ensuring a proper distribution of weight on front and rear axles, whilst also preventing frame distortion and undue wear and tear of tires, etc., occasioned by permitting the use of an incorrectly loaded machine. The specification of the chassis shown in the illustrations is as appended :—

EDISON ACCUMULATOR MODEL "G.M." ELECTRIC CHASSIS.

DIMENSIONS.—Wheel base, 10 ft.; wheel track, 5 ft. 7¼ in.; maximum body width between wheels, 4 ft. 8 in.; distance from driver's seat to end of frame, 10 ft. 4 in.; distance from rear of battery box to end of frame, 8 ft.; height of frame from ground, 2 ft. 8 in. width of frame, 3 ft. 4 in.; overall length of chassis, 15 ft. 10 in.; overall width of chassis, 6 ft. 7¾ in.

WEIGHT.—Complete chassis without Edison battery, 4,026 lb.

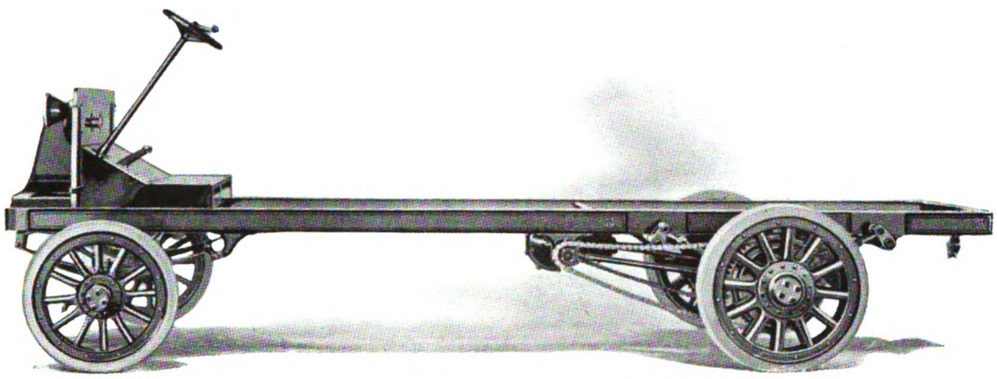
MOTOR RATING.—Normal volts, 60; normal amperes, 40; normal revolutions per minute, 900.

ACCUMULATOR.—Type of cells, A-8; number 60; capacity A.H., 300-340; average volts, 70; K.W.H. output, 24; weight complete, 1,818 lb.; normal charging rate for 7 hours: amperes, 60.

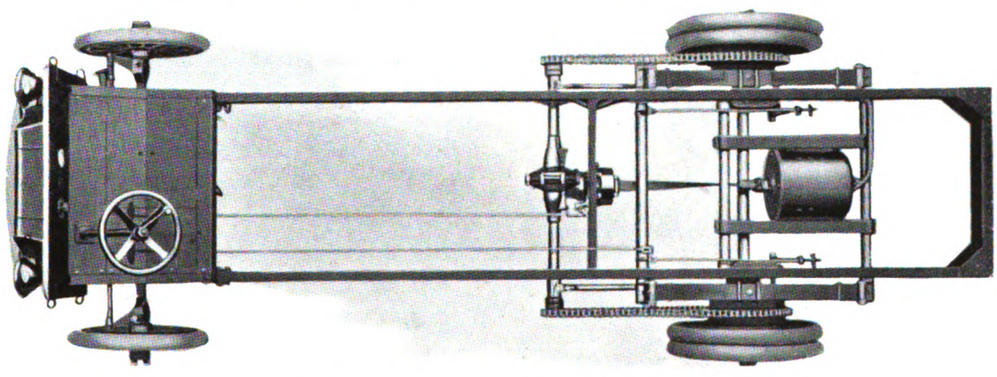
TIRE SIZES.—Front, 820 by 100 mm. single; rear, 900 by 90 mm. twin.

SERVICE DATA.—Speed fully loaded, 11 to 12 miles per hour (speed is calculated on good, hard, level roads); miles per charge, fully loaded, 40, half-load 50; mileage gained by one hour's boost (high rate charge) at twice normal rate, 15.

Special features of the model may be briefly alluded to. There is good suspension under all possible conditions. An accessible and protected position is given the accumulator on the top of the chassis and partly under the driver's seat. Thus the driver or garage man has merely to raise a flap in order to have the whole battery instantly under inspection, while the vehicles may be garaged hub to hub where space is congested, and the absence of side-sway reduces the wear on the tires. The controller, safety switch, ampere-hour meter, and all wire connections are placed under a hood in front of the dashboard. There is a flexible drive from the motor to the countershaft; hence every shock of stopping and starting is cushioned from within the machine. Tire and chassis expenses are thus lessened, and the vehicle starts as smoothly as though controlled by compressed air.



Elevation of Edison 2-ton Chassis—Model G.M.



Plan View of Edison 2-ton Chassis.

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MOTOR TRAFFIC.

ELECTRIC CHASSIS WITH TIPPING BODY.

Sufficient demonstrations with electric dust trucks have now been given to render local authorities anxious to secure such aids to economical working. The illustrations on this page depict the 40-cwt. vehicles delivered to Dover and Nottingham Corporations for the collection of house and shop refuse.

In each instance automatic tipping gear, electrically operated, is attached to the G.M. chassis model of the Edison Accumulator, Limited, Duke Street, London, S.W., and the bodies supplied to the order of Dover manifest an improvement upon those sent to the inland city in that the height is slightly lower. The body is entirely constructed of sheet steel reinforced with angle and channel sections, hot riveted. The upper sides are hinged so as to allow easy loading. By means of cables and pulleys the sliding panel is automatically raised when the body is tipped, and closed on the body returning to normal position. The whole body is galvanised. The capacity is 35 cubic feet.

The tipping gear is electrically operated and put into action by a simple reversing switch. A small electric motor gives the body a direct thrust backwards through the medium of a reduction gear and square threaded screw of ample proportion.

The body is provided with rollers, which run on a steel runner path of special profile so that when the body is pushed backwards a tilting motion is also given to it. This arrangement possesses the advantage that the bodywork is stable in all positions, whilst the centre of gravity travels almost horizontally; thus the amount of energy used for tipping and the time taken for the process are greatly reduced as compared with other mechanical methods in use for effecting this action.

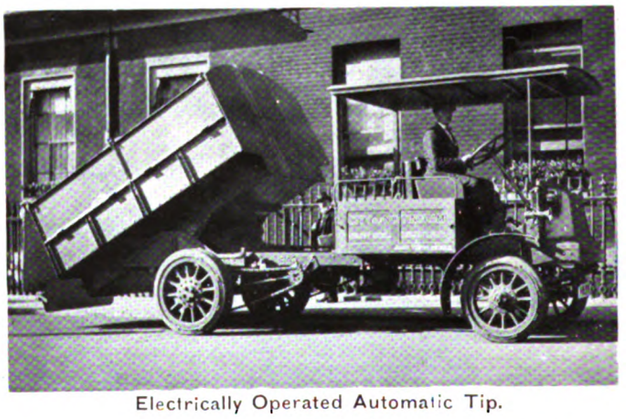
Reference appears in another column to the specifications and advantages of the three patterns in which the 2-ton type of Edison accumulator vehicle is supplied. These provide three lengths of frame and wheel base, namely, short, medium, and long, thereby giving a wide choice to suit every class of service in which battery vehicles can be operated with profit. In such work as dust collection the three lengths enable municipal engineers to provide for successful operation in narrow as well as wide streets. Dover thoroughfares mostly come under the former category, and the firm have a number of similar vehicles on order for other towns with narrow streets.

Power is provided by an Edison battery of 20 cells type A-4, 150 ampere-hours capacity, located in an accessible steel compartment on the top of the chassis and partly under the driver's seat. The motor is specially designed, having high starting torque and high efficiency; it is series wound for 24 volts. The armature is carried on annular ball bearings, and has a capacity sufficient to propel a loaded truck up a 15 per cent. to 25 per cent. grade. The controller is of the drum type, eliminating all arcing in operation.

Edison 2-ton Dust Truck Supplied to Dover Corporation.

Power cannot be applied without first releasing the brake, which automatically closes the circuit switch. Directly the current is off, the brakes will set automatically, and remain set until the circuit breaker is again closed, when the band brake is automatically released. The controller handle is located above, and with its spindle concentric with the steering wheel, thus being always convenient to the driver's hand. This is an important consideration in an emergency, besides obviating the possibility of it being caught by a person's clothing, as may happen with side lever controller handles

Nottingham Corporation's Edison Truck.



Electrically Operated Automatic Tip.

SURVEYORS AND THE LOCOMOTION TAXES.

The Institution of Municipal and County Engineers have asked the Chancellor of the Exchequer to relieve their members of the motor spirit and the local taxation licence duties when carrying out their work of constructing and maintaining roads. The following precedents are quoted in support of the application:—

Under Section 36 of the Highway Act, 1862, highway surveyors were exempt from paying tolls.

The relief granted to physicians and surgeons and proposed to be granted to veterinary surgeons under the Finance Acts.

Inland Revenue officials are exempted from payment of licence duties.

Under the Locomotives Act exemption is given from payments for steam rollers.

Omnibuses plying for hire pay half the motor spirit duty on the petrol consumed, and reduce their charges still further in this direction by using diluted spirit.

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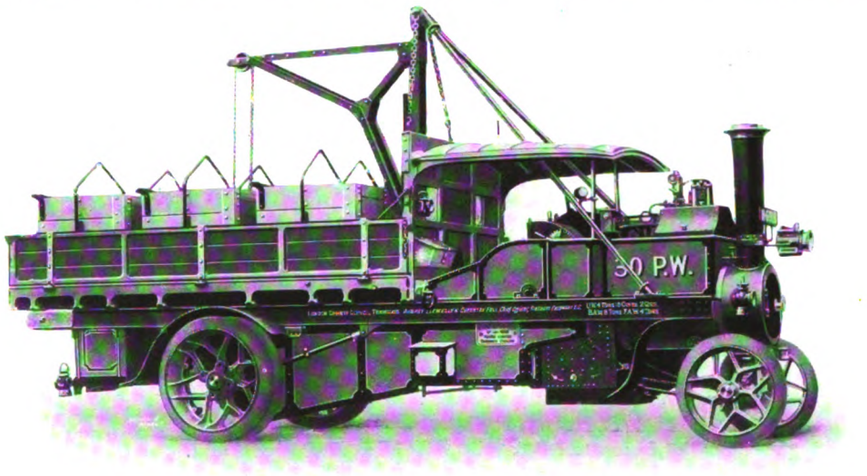
MOTOR TRAFFIC.

FODEN WAGONS FOR L.C.C. TRAMWAYS.

The Foden steam wagon illustrated below is one of several recently supplied to the tramways department of the London County Council for use on permanent way work. As will be seen, the special feature of the wagon is the fact that it is fitted with a powerful crane. This adds enormously to the utility of the vehicle, which as a labour saving machine is remarkable. The mechanism of the crane, which is operated by the engine, is of the most simple character, all its movements being easily controlled by the driver from his normal position. All kinds of road material can be rapidly and economically handled, while points, crossings, etc., are conveyed to the job and set in position with a minimum of labour, thus effecting a considerable saving both in time and money. The machine is the standard 5-ton Foden steam wagon, the general design of which is notable for its simplicity and reliability. The boiler is of the horizontal multitubular type, and forms the front of the framework. The sides of the frame are constructed of strong channel steel, tied and braced together in such a manner as to secure great strength in the complete lorry. The platform of the vehicle shown is 12 ft. long by 6 ft. 6 in. wide. Spence Moulton solid rubber tires of a special section are fitted. The wagon is driven by a compound steam engine fixed on the top of the boiler. In this position it is readily accessible and able to work with "dry" steam. The cylinders are 4 in. and 6¾ in. diameter, and are fitted with patent high pressure gear by means of which both cylinders can in case of emergency receive live steam from the boiler, and each exhaust independently into the chimney. The reversing motion is of the ordinary link type, and the whole construction of the engine and steering arrangement is so similar to the Foden traction engine that it is claimed by the makers that any ordinary traction engine driver can easily handle the wagon without having had previous experience with this type of machine. The wagon, which is chain driven, is geared for two speeds—three and six miles per hour—and it is capable of taking a load of 8 tons upon itself and a trailer at six miles per hour on normal roads, or of ascending a gradient of 1 in 6 with its full load at three miles per hour.



Foden Wagon for London County Council's Tramway Department.

MOTOR DRIVERS AND ENLISTMENT.

The Commercial Motor Users' Association recently asked for the residue of drivers of heavy motor vehicles to be placed on the reserve list under the recruiting scheme. It is stated that over 25,000 drivers and mechanics have joined the mechanical transport from the employ of commercial motor owners, and the association urged that it is more economical to enlist men and train them than to dislocate transport work further by offering 6s. a day.

The object sought for by the Council of the Association has been attained, for on December 18 the Board of Trade added the following to the list of reserved occupations in respect of which appeal can be made to the local tribunals:—"Carters, lorrymen, and draymen (horse or power), not engaged in delivering to private houses. This reservation is in addition to the classes of carters, lorrymen, and draymen reserved under specified trades."

THE BRITISH QUANTITY CAR.

PROBLEMS CONFRONTING BRITISH MAKERS.

The appended article from the pen of "J. O.," the well-known motoring correspondent of the *Westminster Gazette*, published in the issue of that journal dated December 28, is worth the consideration of British manufacturers of motor cars for private use.

The *Autocar* is still busy examining the pros and cons of the British quantity car, but the more that is said on the subject the more confusing it becomes. Last week's subscriber to the controversy was "A British Automobile Manufacturer," who is of the opinion that any scheme to be successful should comply with the following conditions: (1) The car must be a fully equipped four-seater of ample power, to sell at £200; and (2) it should be a co-operative product to benefit the trade as a whole. To achieve this result each manufacturer shall devote a portion of his factory to the making of the parts, which would be erected at a central assembling shop owned by the co-operators, who would distribute the cars to the public through agents.

This is, as far as it goes, a sensible suggestion, but unfortunately it only half meets the case. The price is nearly right for a fair-sized four-seater of ample power, but as it is considerably more than is asked for the better class of cheap American machines, such as the Dodge Brothers, Maxwell, and Briscoe, it is doubtful if it can be made to compete with them and others in the same field. If, on the other hand, this £200 model is intended to affront the Ford, then it must fail hopelessly. It is clearly apparent that to succeed in an entirely new enterprise of this kind the trade must determine (1) what is the best value for money America offers in a four-cylinder machine; (2) if this best value for money design is actually the best selling car in its class; and (3) if it is popular in this country and in the Colonies. This settled, the next move is to inquire how closely the selected design can be reproduced at approximately the same price, for it is inconceivable that we can match it for £50 or so less. This is one aspect of the question.

The other and more important aspect is the much cheaper car, one that can successfully compete with the Ford, which sells in this country in greater numbers probably than all the other American machines put together. Here, again, we must accept as our pattern the model which is the cheapest and most popular in this class. We cannot, of course, infringe the Ford patents, but it would be perfectly legitimate to take it as our standard of quality, of weight, and power. The Ford has but two speeds of the epicyclic type, and two speeds should be all-sufficient for the British-built Ford, if the power and weight are about equal. The epicyclic gear can be made in comparatively small quantities for a few pounds a time, and is free for anyone to make. We could not adopt the Ford ignition, but we could produce a system quite as cheap. We could not, perhaps, employ the Ford epicyclic steering, and on this component we must expect to have to pay a little more. A display of ingenuity might produce a simple form of suspension which would reduce the cost of the frame to a few shillings. And we could with advantage freely employ the Ford system of casting the cylinder head and half the crank case in one piece. The reader will say to himself what

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MOTOR TRAFFIC.

an amazing design the Ford is that we are compelled to look up to it for all our ideas on how to produce a very cheap car. It is, and motor manufacturers in this country and America must know it, even though they are disposed to sneer.

You may call the Ford car a perambulator or a piece of sheet iron or an ironmonger's job, but it is a triumph of cheap production and quality. I have urged this over and over again to try and wake up our manufacturers, but the answer has always been, lack of output. The Ford Company are turning out 250,000 cars a year, they say how can we get the price down on a paltry few thousands? But the Ford people did not start by producing 250,000 cars a year. As a fact (according to the figures given in the *Motor* of September 7, 1915), when the first Fords were selling in New York City at £105 a time (this is my own figure) —in 1903–4, the output amounted to only 1,708 machines; in 1905 it was still less— 1,695; in 1906 it went down again, to 1,599; but in 1907 it rose to 8,423; and not even as late as 1910 did it touch the 20,000 mark. Can it be that during all these years the company were losing money? No; it is more than likely the organisation was planned from the smallest stages of its development to turn out the Ford car for what it is costing the makers now.

That is a very important point to keep in mind. It may be that in the beginning Mr. Ford was able to carry the science of production for comparatively small lots further than we can hope to do even now with much larger lots, but we must remember that in the manufacture of nearly all things in large quantities there is a point in the cost below which no further economies are possible. This critical period we can only guess at random, and I would myself put the hypothetical figure in the case of light motor cars at 10,000. If this could be accepted as more or less correct, then we can go right ahead with confidence on a machine of the Ford class, because we know we could dispose of the output, assuming that the price, power, accommodation, quality, and equipment are the same.

DENNIS 3-TON SUBSIDY MODEL.

BREAD CONVEYANCE TO WILTSHIRE CAMPS.

The lorry illustrated below has recently been supplied by Dennis Brothers, Limited, of Onslow Works, Guildford, to Messrs. G. Williams and Sons, of Shrewton, Wiltshire. This firm are bakers and contractors to the Government, a circumstance that no doubt explains the opportunity given to them for the purchase of the lorry. The vehicle is of the standard type as supplied to the War Department, and will be used for carrying bread to the various camps in

Dennis Lorry for Military Bread Delivery.

the district and for the carting of flour, etc. It will be noticed that excellent weather accommodation is provided for the driver, as well as the covering for the contents of the lorry.

A full description of the Dennis 3-ton War Office subsidy model, accompanied by six illustrations, was given in our issue dated August 12 last. This type won its place in the subvention scheme as the result of the exhaustive trials carried out a few years ago; and in the trying work that it has been subjected to in France during the past seventeen months the vehicle has added to its laurels. These Dennis conveyances had long before that period established their worth in peace with many prominent firms in this country, and during the long periods of pressure on the railways since the outbreak of war this and heavier models have proved of inestimable benefit both to the Government and private owners.

ALBIONS FOR CIVILIAN USERS.

The Albion Motor Car Company, Limited, while still supplying a large proportion of their output to H.M. War Office for war purposes, state that a limited number of 3 and 4-ton Albion vehicles are now available for civilian users. Among numerous purchasers from whom orders have been received recently are the

32-h.p. 3-Ton Albion Lorry for Glasgow.

North British Locomotive Company, Limited, Glasgow; Union Castle Mail Steamship Company, Limited, London; the Rapid Motor Transport Company, Limited, Glasgow; and Wm. Baird and Company, Limited, Ironworks, Gartsherrie.

CHARGING OF BATTERY VEHICLES.

ESSENTIAL POINTS OF PLUG AND SOCKET STANDARDISED.

The great importance to the electrical and motor vehicle industry of standardising the charging plug and socket used in connection with vehicles propelled by secondary batteries was brought to the notice of the Engineering Standards Committee by the Electrical Vehicle Committee of the Incorporated Municipal Electrical Association in March, 1914. In October of the same year certain proposals for the standardisation of a particular plug and socket, which the latter committee had drawn up and based on the recommendations of the Electrical Vehicle Association of America, were considered in detail. In order, however, not to depart from their guiding principle of interfering as little as possible with invention and progress, the sub-committee, after careful consideration, decided not to suggest, as standard, any detailed design, but to confine their attention to standardising only the essential points necessary to secure interchangeability between any charging plug and any socket of the type selected by the Electric Vehicle Committee (viz., concentric), leaving to them the issue of a detailed specification for the construction of the exact design of plug which, in their opinion, is best suited to the present needs of the industry.

In issuing the standard specification the sub-committee express their indebtedness to the Electric Vehicle Committee for their cordial co-operation in the matter, and it is mentioned that the sub-committee were assisted in the preparation of the specification by Mr. Frank Ayton, hon. sec. of the Electric Vehicle Committee.

The sub-committee have also issued the British standard specification for wall plugs and sockets (five Empire two-pin, without earthing connection), for pressures not exceeding 250 volts. In consultation with the manufacturers the dimensions necessary to obtain interchangeability have been agreed upon, the actual design of the plug being interfered with as little as possible. It is of interest to note that the standard plug is required to have side entry for the flexible wire and a suitable hand shield.

The Reports, the prices of which are 5s. 3d. and 5s. 4d. post free respectively, may be obtained direct from the offices of the committee, 28, Victoria Street, Westminster, S.W.

WIDNES CORPORATION OMNIBUSES.—The Omnibus Committee have reported that the running cost of the motor omnibuses during the past six months was 10·2d. per mile, and the receipts 13d. per mile. An additional vehicle had been ordered.

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MOTOR TRAFFIC.

A HINT TO PROSPECTIVE PURCHASERS.

Although D. Napier and Son, Limited, are able to supply commercial and public passenger motor vehicles under certain circumstances, orders for private cars cannot at present be executed. In seconding the adoption of the directors' report at the annual meeting held at the works at Acton, on December 20, Mr. H. T. Vane, joint managing director, explained that the delay in executing orders for pleasure vehicles was due to the special Government work that had been entrusted to the company. He hoped that, when this state of affairs terminated, prospective purchasers of motor vehicles would support those British motor manufacturers who, like the Napier Company, had arranged their works at this critical period to suit the urgent requirements of the British Government. He would even say that he hoped the Government would offer some protection, if only temporarily, after the war, to enable such firms to have sufficient time to rearrange their works and organisation for civilian trade.

Mr. Montague Napier, who presided, and moved the adoption of the report, said that practically the whole of the output of Napier vehicles had during the past season been supplied to the British and Allied Governments, and at present the whole of the company's output of Napier chassis was being supplied to the British Government and firms engaged on Government work. The investments, which stood at £13,750, had realised in dividends and interest during the period under review a sum of £1,903, which showed that they were of a remunerative character. The dividend on ordinary shares of 5 per cent. for the twelve months compared with 3 per cent. for the previous sixteen months' trading, and a further £20,000 had been carried to reserve this year, whereas nothing had been placed to reserve in the previous financial period. The fact that the company is a "controlled" establishment should assist in keeping the works fully employed during 1916, and, having regard to the special nature of the work on which the company were now engaged, it should further advance the Napier reputation for high-class work.

The annual report for the year ended September 30 showed a profit of £70,173, after charging all depreciation, but before charging debenture interest (£5,500). Preference share dividend absorbed £22,500, ordinary share dividend £17,500. To the reserve fund £20,000 was added, and £9,839 was carried forward.

SIMPLEX PETROL CARS.

CONTINUED SUCCESS IN INDIA.

At the annual meeting of the East Indian Tramways Company, Mr. John Abbott, the chairman, in submitting the accounts for the year ended July 31, 1915, said that their unique system of tramways was still having as great a success as ever. The net receipts would again have exceeded those of the previous year if the expenses had not been so much greater. This increase was explained by a large increase in their income-tax. He felt very hopeful of the future in view of the fact that the receipts for the first four months of the present year had created a fresh record.

Readers will remember that the East Indian Tramways Company uses cars equipped on the Simplex petrol system, and it also operates road motor vehicles. The Simplex tramcars during the past year ran 599,725 miles at an average running cost of 4·31d. per car-mile, while the receipts were 9·52d. The road vehicles ran 31,708 miles at an average cost of 8·97d., the receipts being 9·99d. The running cost per mile was made up as follows:—Traffic expenses, 1d.; petrol and lubricating oil, 1·44d.; repairs and maintenance, 1·06d.; depreciation, ·81d. The balance available for dividend was £7,149, sufficient to pay a dividend of 5 per cent. on the cumulative preference and ordinary shares, which with the interim dividend of 2½ per cent. paid on May 31, 1914, made 7½ per cent. for the year; and 10 per cent. on the deferred shares, leaving a balance of £104 to be carried forward.

HALLEY'S INDUSTRIAL MOTORS, LTD.

In their report and accounts for the period ended October 2, 1915, upon which date the works were placed under the control of the Minister of Munitions, the directors announce a gross profit of £67,443, to which had to be added £12,030 brought forward. After writing off £7,427 for depreciation, carrying £10,000 to reserve, and placing £25,000 to special reserve against Finance Act legislation and other contingencies due to the war, there remained a balance of £37,046, less £5,250 interim dividend. This was apportioned as follows:—£10,500 to final dividend at 5 per cent. (actual) and a bonus of 1s per share free of income-tax. The balance of £21,296 is to be carried forward to next year, subject to directors' fees and bonus to employees.

NATIONAL STEAM CAR COMPANY LTD.

The report for the year ended October 31 states that, after making provision for all expenses, including maintenance and annual overhauling of the omnibuses, depreciation of plant, tools and buildings, the profit was £33,682. Of this sum £16,500 had been placed to the special reserve for the renewal of omnibuses, leaving a net profit of £17,182. With the amount brought forward of £617, this made a total of £17,800 to be dealt with. The directors had transferred to general reserve fund £3,000, and they recommended a dividend of 6 per cent. on 157,500 £1 shares, which, with the bonus payable to the managing director, would absorb £10,395, leaving a balance to be carried forward of £4 405. For 1914 the dividend was 5 per cent. The average number of omnibuses licensed during the year was 160, and the report stated that the vehicles had been maintained in the highest possible state of efficiency, having regard to the special conditions prevailing on account of the war. The services both in London and Chelmsford had been accorded their fair share of the patronage of the public.

In the balance sheet the total revenue was given as £186,894, and the running expenses £151,840. The nominal capital was £200,000 in £1 shares, of which 157,500 had been issued. The total reserves were given as £56,500. Capital expenditure amounted to £54,309, and the value of the omnibuses, stock of materials, works in progress, lorries, at or under cost, was given as £150,344. Other assets included £24,289 for freehold land and buildings, less amount written off; £19,177 for leasehold land and buildings, less amount written off; £733, furniture, fittings, etc.; and £9,326 cash at bank and in hand.

A SATISFACTORY YEAR.

At the annual meeting on December 30, Mr. T. Clarkson, who presided, said that the sum allocated in respect of overhaul was about 12 per cent. greater, an increase rendered advisable partly in consequence of the rise in cost of material. The sum of £3,000 was again carried to general reserve. The carry-forward had been increased to £4,405, compared with £617. The reserves now reached £59,500. The financial position was stronger that day than it had ever been. The profits might have justified them in recommending a larger dividend than 6 per cent., but they had to take into consideration the present difficulties of finance and the developments in the business at Chelmsford. In referring to the strike of some of the employees early in the year, the Chairman said it was curtailed by the dismissal of the disloyal element, and in only a few cases had those men been reinstated. The Commissioner of Police had sanctioned the employment of women conductors, and a start had been made. At Chelmsford they were performing their duties in a most satisfactory manner. The company were executing orders for munitions, and consequently the manufacture of coke motors and the Clarkson wheels was considerably restricted.

THE OUTLOOK FOR HEAVY MOTORS.

He might mention that they were continually being called upon by the authorities to transport the wounded, and there was no doubt that their fleet had in this way and others served very valuable purposes. The orders in hand were sufficient to keep their works engaged night and day for many months to come, notwithstanding the enlargement of their resources, and he had no doubt that for the period of the war they would be working at the extreme limit. The Board had come to the conclusion that on the cessation of hostilities the demand for heavy motor vehicles would be exceedingly large. The war would confirm the opinion he had long felt that heavy motor traction on the roads must increase. At the commencement of the war large numbers of heavy motor vehicles were commandeered. Wastage in this department during the war had been enormous. The orders which firms were unable to execute to-day, owing to their efforts being fixed on munitions production, ran into thousands, and he believed that on the cessation of hostilities the demand upon the immediate resources of the company would keep the works very fully engaged. The report was adopted.

SIDDELEY DEASY AMBULANCES.

At the annual meeting of the Siddeley Deasy Motor Car Company at Coventry on December 20, Sir R. Waldie Griffith (chairman) said that the net profits for nine months were £35,118, and £11,450 was brought forward. A dividend of 1s. per share was proposed, carrying forward £30,468. The works are now solely occupied in producing ambulances and munitions of war for the British Government.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

MOTOR OWNERS' PETROL COMBINE.—The announcement was made on December 29 that payment of interest on the 6 per cent. first debentures will be deferred.

ELECTRIC DELIVERY VAN.—The Industrial Co-operative Society of Ipswich has ordered a 2½-ton electric battery delivery van from Messrs. Ransomes, Sims and Jefferies, Limited, Ipswich.

LONDON-BIRMINGHAM GOODS SERVICE.—Under the auspices of the Birmingham Garages, Navigation Street, Birmingham, a daily return service has been instituted between that city and London. Six Bessemer motor wagons are utilised, and the delivery of goods is promised within twenty-four hours.

A YEAR OF ELECTRIC VEHICLE PROGRESS. Electric vehicles now in use in this country number 660, as compared with 150 a year ago. The great majority of these are equipped with Edison accumulators, supplied by Edison Accumulators, Limited, of 2 and 3, Duke Street, London, S.W. Seven tramway authorities own Edison battery vehicles.

REPLACING HORSE TRAMCARS WITH MOTOR OMNIBUSES.—It was announced by the chairman of the Lancaster and District Tramways Company, at the annual meeting recently, that since the war the horse tramways could not be worked at a profit, and he hoped the new motor omnibuses, to be run in conjunction with another company, would be profitable.

AMBULANCE CHASSIS.—Eight tenders for providing twelve ambulance chassis were received by the Metropolitan Asylums Board, but none were from firms who have hitherto supplied those machines. The Board have therefore decided to build six cars similar to two that they themselves constructed in 1913-14. The new cars are required to replace others that are becoming too worn.

PNEUMATIC TIRES FOR HEAVY VEHICLES.—The Goodyear Tyre Company, London, are about to experiment with pneumatic tires up to 12 in. section on heavy commercial vehicles. It is stated that such tires have stood a three years' test in America. A 9 in. tire, it is said, will carry up to 4,500 lb. on the front and rear axle respectively, or a total weight of over four tons, while the 12 in. is equal to 7,500 lb. per axle, or a total of over 6½ tons.

TENDERS FOR MOTOR SPIRIT.—The following tenders were received for the supply of motor spirit to Shoreditch Council:—British Petroleum Company, Limited, Shell 1s. 10d., Shell II. 1s. 9d., Crown 1s. 8d. per gallon (recommended for acceptance); Petrol Users' and Traders' Supply Society, Limited, 1s. 10d.; Anglo-American Oil Company, Limited, Pratt's Perfection 1s. 11d. and 1s. 10d., Pratt's II. 1s. 10d. and 1s. 9d., Taxibus 1s. 9d. and 1s. 8d.

NEW USE FOR A CORPORATION MOTOR OMNIBUS.—A deputation from Bolton Tramways Committee were conveyed to Oldham in a motor omnibus belonging to the tramways department of Bolton. In reporting the visit at a meeting of Oldham Tramways Committee, Councillor F. Elliott, vice-chairman of the latter committee, said the omnibus was one of the most beautiful and serviceable vehicles he had seen. It was used by all the committees, and was let out to the other committees at a cost of 50s. per day, or 5s. per hour.

WOOD-MILNE TIRES IN INDIA.—Although the home demand for Wood-Milne pneumatic and solid tires continues greater than ever, this firm are not neglecting that most important branch of the nation's business, the export trade. Mr. A. D. McHaffie, is responsible for the management of "Wood-Milne" (India), Limited, with branches at Calcutta (70, Bentinck Street) and Bombay (201, Hornby Road), Fort. Mr. McHaffie, who is well-known in Indian motoring circles, sailed in October, and his arrangements are now practically complete.

MOTOR-OMNIBUS COSTS.—Reporting on the running of the motor-omnibuses of Bournemouth Tramways department for the half-year ended September 30, Mr. I. Bulfin, general manager, states that the running expenses showed a decrease from 9·48d. to 9·20d. per car-mile. On the Boscombe to Pier route the receipts averaged 13·28d. per car-mile, as against 15·32d. in the previous year. In the absence of the steamboat excursions the result might be considered satisfactory. From Westbourne Arcade to Alum Chine the receipts averaged 10·71d., as against 7·45d.

MOTOR CONVEYANCES FOR WORKMEN.—An important consideration in the provision of motor transit for workmen by their employers was revealed at an inquest held at Gloucester recently, on the body of a labourer who died from injuries sustained by being run over by a motor chars-a-banc. Deceased was employed by Gloucester Construction Company, who provided a considerable number of motor vehicles to take the men to and from the works. The description of the conveyances varied somewhat, but two were comfortable, covered chars-a-bancs, and to these the workmen were in the habit of making a rush. In such a rush the deceased fell, and his body became pinned under the rear wheel.

MOTOR VEHICLES FOR MUNICIPALITIES.

ERITH COUNCIL have accepted the tender of Dennis Brothers, Limited, to supply a motor fire engine with a ladder attached at a cost not exceeding £895.

SOUTH SHIELDS ELECTRICITY COMMITTEE have advised the Corporation to purchase a battery-propelled vehicle for ash removal at the power-station, at £850.

ERITH URBAN COUNCIL, on obtaining a Provisional Order from the Board of Trade enabling them to run motor omnibuses in connection with their tramways, propose to purchase three such vehicles.

SALFORD COUNCIL have approved of the Electricity Committee's proposal to place a contract with the Albion Motor Car Company, Limited, for the supply of a 4-ton Albion petrol motor wagon, at £775.

NEWCASTLE-ON-TYNE CORPORATION have received a report from the Fire Brigade Committee in favour of purchasing a petrol motor fire engine with a turbine pump from John Morris and Sons, Limited, Manchester.

SYDNEY COUNCIL (N.S.W.) have accepted the tender of Dalgety and Company for the supply of three Baker electric wagons fitted with Edison A10 cells, at £1,180 each, and a 5-6-ton Leyland petrol lorry.

LEEDS EDUCATION COMMITTEE were informed on December 22 that the Gas Committee of the Corporation were obtaining two new motor wagons in order to cope with the difficulties that had arisen in supplying coke to the schools.

EASTBOURNE CORPORATION have ordered ten chassis of the War Office subsidy type from Leyland Motors, Limited. The War Department are permitting the company to execute the order on condition that there is no reduction in the number of vehicles required per week from them for national purposes. The chassis are wanted for the omnibus undertaking.

THE STUDEBAKER CAR.

From Studebaker, Limited, we have received the "Studebaker Proof Book," a profusely illustrated work issued for the purpose of affording proof of the qualities of these well-known motor cars. In a foreword it repudiates the notion not yet extinguished that the output of American factories is necessarily "cheap," in the invidious sense of the word. As a matter of fact, the best types are not, and this finely-printed folder shows "the solid foundation of a great American business enterprise and the perfection which has been achieved in the production of a great American car." The factories of the Studebaker Company cover nearly 150 acres, and the number, size, and diversity of the plant, are little short of marvellous. Sixty thousand cars are made annually. Steel is bought in train-load lots. Two and a quarter million animals have to yield up their hair, and the hides of 150,000 head of cattle are required for upholstery. Two thousand parts go into a car made several times stronger than will be necessary to meet the demands of average service. Amongst the six divisions of the engineering departments are metallographic, chemical, physical, and electrical. How a Studebaker motor is made is deeply interesting, and another attractive study treats of silent gears. Even the mere skimmer of matters mechanical will be delighted with the illustrations, nearly 100 of them, showing different incidents and processes of manufacture, as well as complete cars. A copy of the booklet will be sent without charge on application to Studebaker, Limited, 117-123, Great Portland Street, London, W.

BRITISH WORKMANSHIP IN WAR VEHICLES.—Mr. Geo. W. Watson, on January 12, read a paper on "Live Axles for Commercial Vehicles," at a meeting of the Institution of Automobile Engineers. The author mentioned that any information that was obtainable in regard to experience with the thousands of vehicles with the Expeditionary Force would appear to show that no small percentage of the troubles experienced had related to back axles. British designers and constructors would be pleased to learn that comparatively few failures had occurred with axles entirely of home design and manufacture.

FODEN'S NEW CATALOGUE.—Fodens, Limited, of Sandbach, Cheshire, manufacturers of "Foden" steam wagons, have issued an illustrated catalogue that should be perused by present and prospective users of mechanical traction. The publication is an excellent guide to the many uses to which these machines can be applied. Information is also given on the cost of running and upkeep. The catalogue, which consists of 72 pages of art paper and a cover, is beautifully printed, and it illustrates both the 3-ton and 5-ton models, fitted with various bodies. Copies will be sent by Fodens, Limited, on receipt of application.

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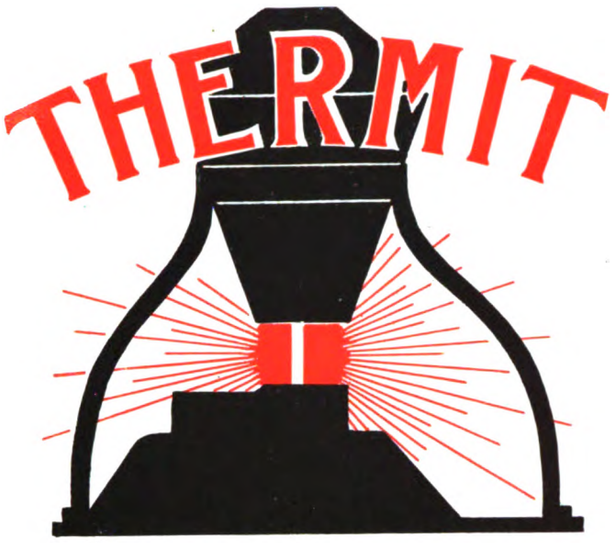

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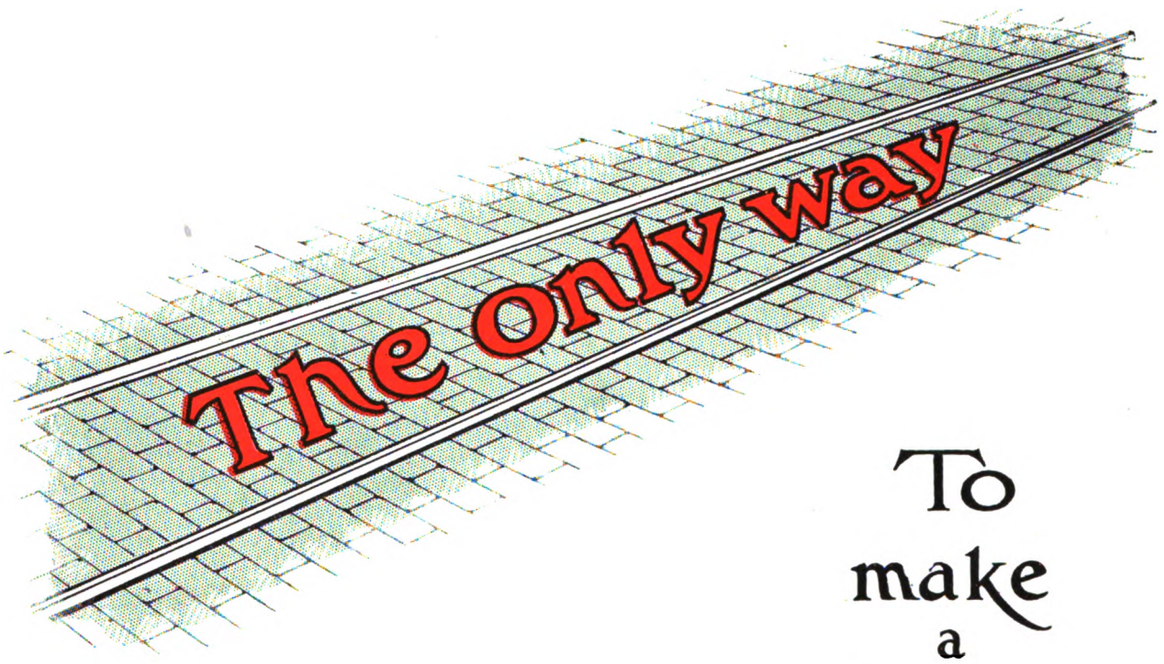

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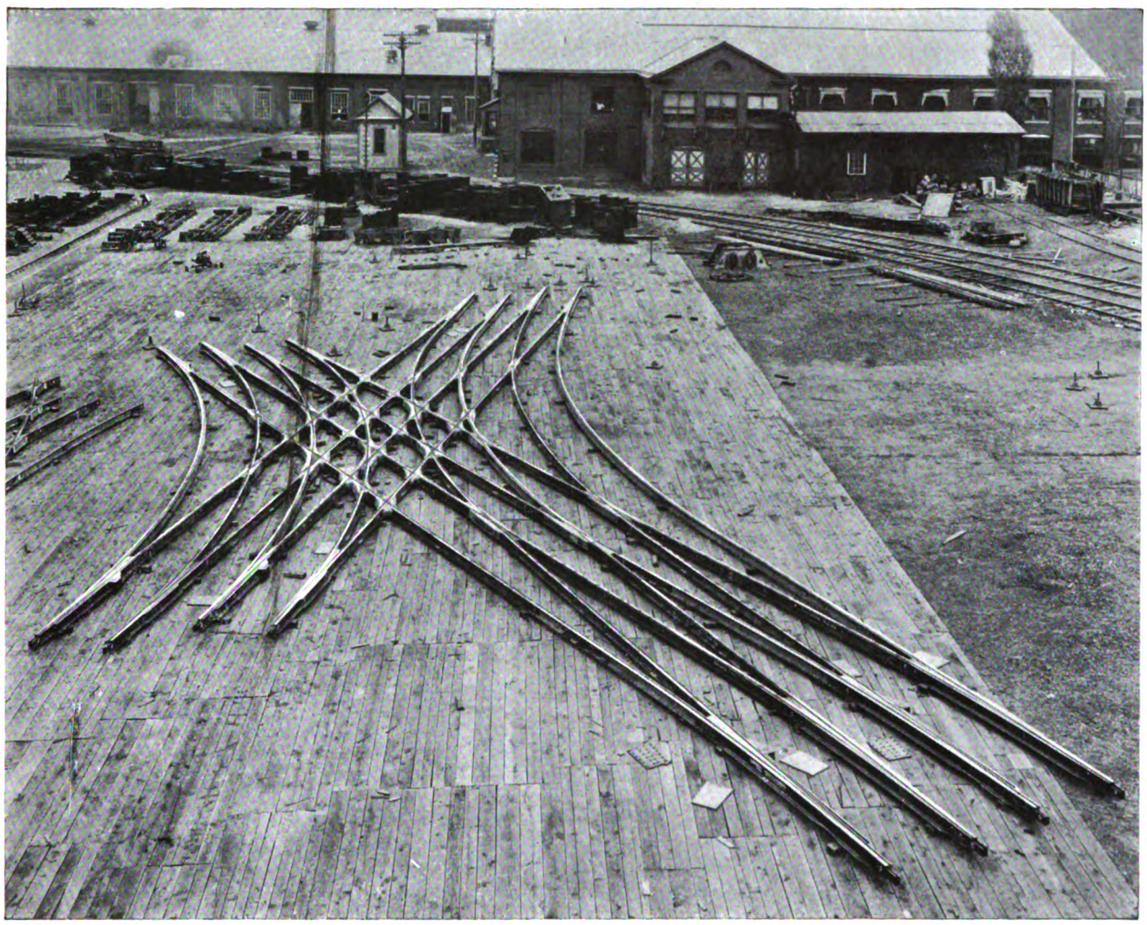

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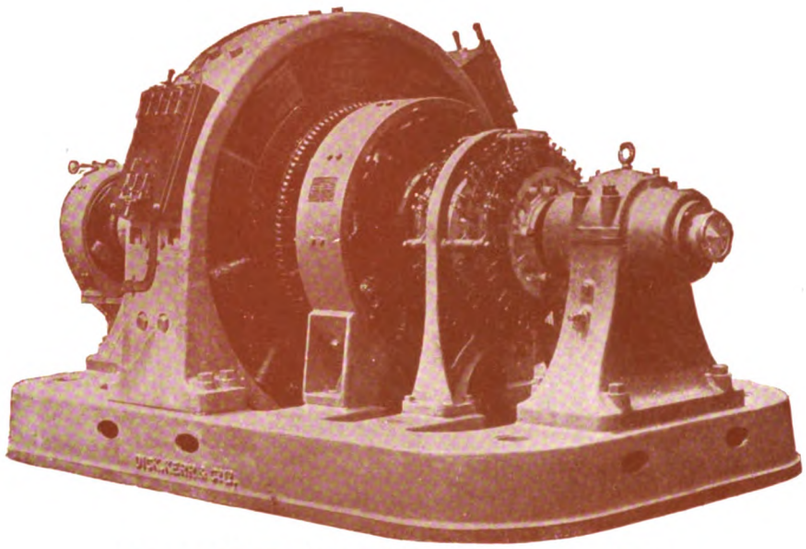

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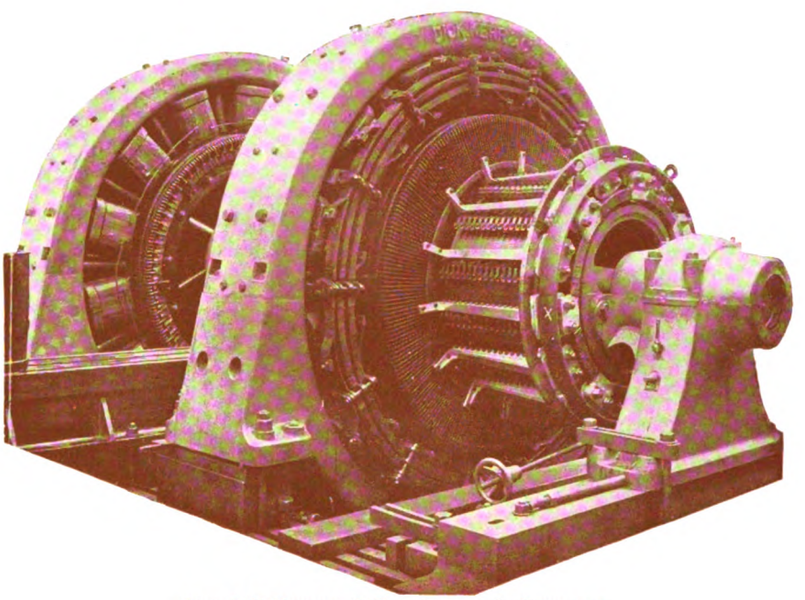

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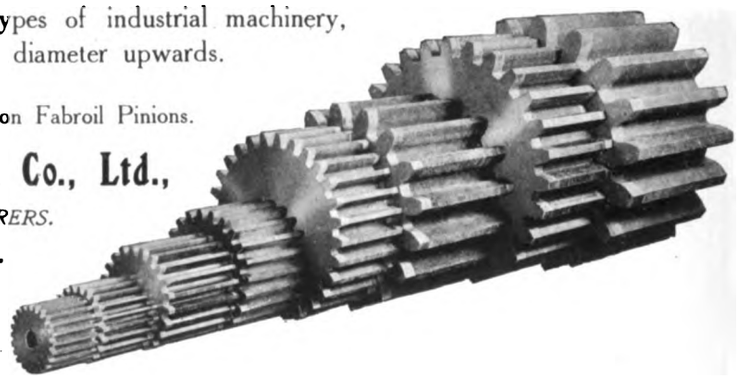

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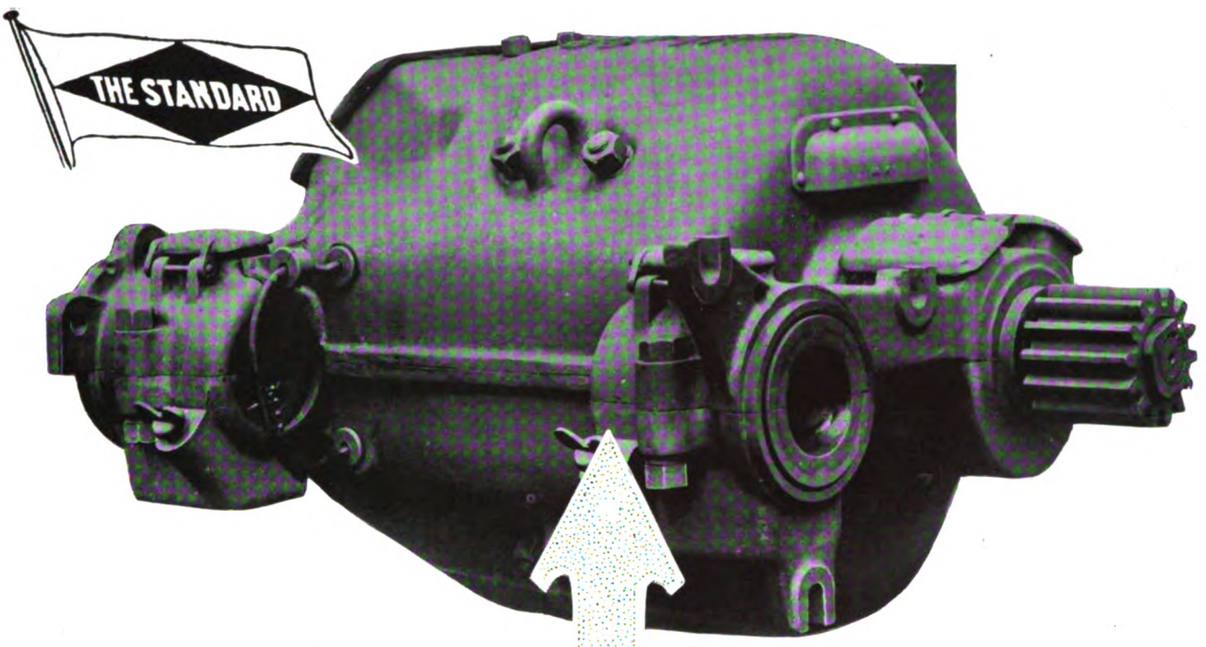

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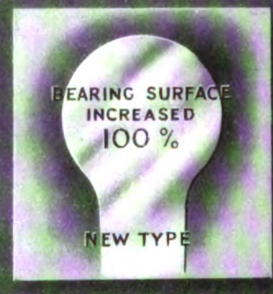

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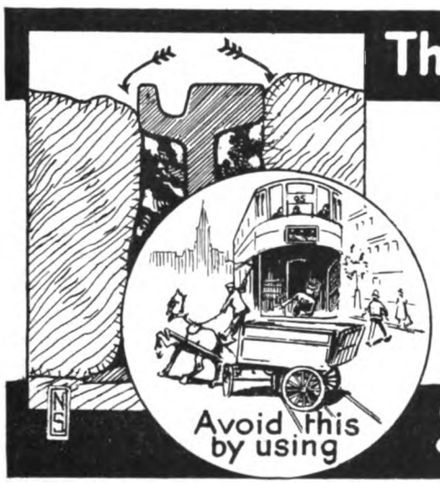

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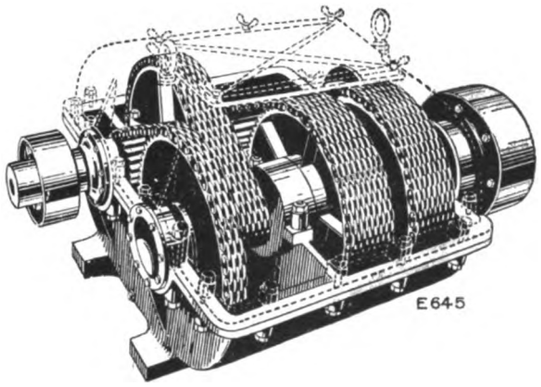

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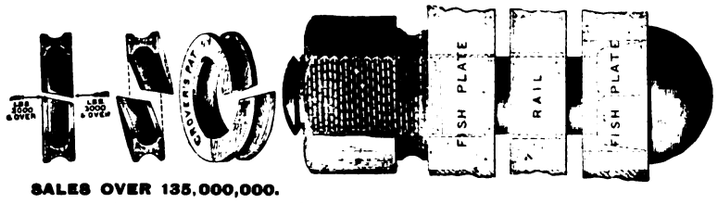

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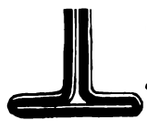

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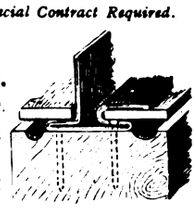

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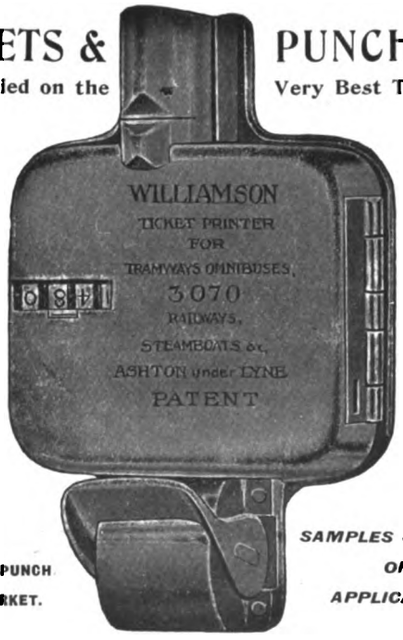

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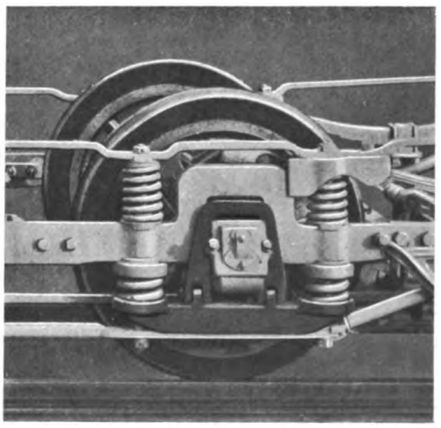

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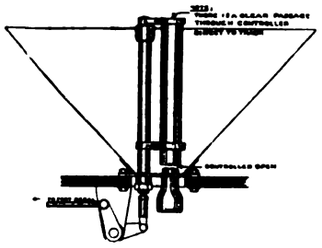

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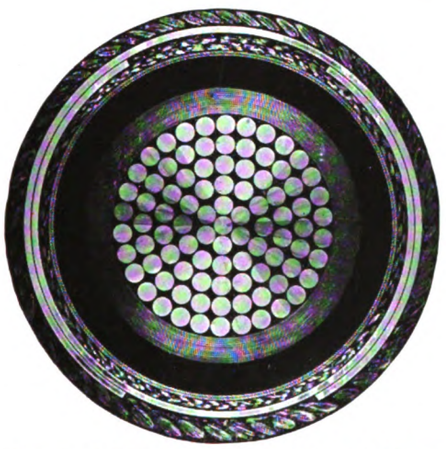

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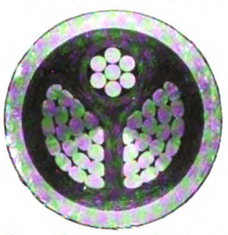

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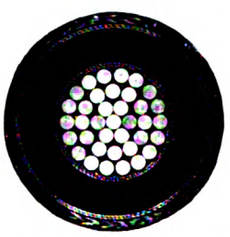

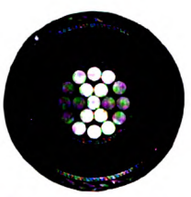

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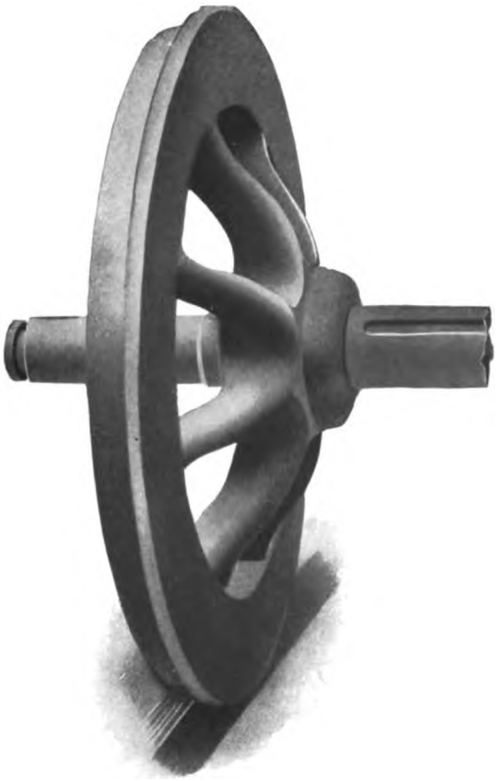

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NAMES OF PRINCIPAL OFFICERS,

POSTAL ADDRESS, TELEGRAPHIC ADDRESS, AND TELEPHONE NUMBERS.

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[Leased. See Dartford Tramways in list of Tramway Companies.]

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Eccles Corporation Tramways, Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Ald. W. J. Nuttall, J.P.; *Vice-Chairman*, Coun. Alexander.

[Lines worked by Salford Corporation.]

Erith Urban District Council Tramways, Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, J. C. Williams; *Cons. Engs.*, Hawtayne and Zeden; *Chairman Try. Com.*, Coun. G. C. Humphreys.

Exeter Corporation Tramways, Paris Street. Exeter. *Manager*, H. C. Bartlett; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, Ald. H. B. Varwell; *Vice-Chairman*, Coun. F. G. Towill.

Farnworth Urban District Council Tramways, Albert Road, Farnworth. *Chairman Try. Com.*, Coun. W. B. Richardson; *Vice-Chairman*, Coun. Stones.

[Lines leased to the South Lancashire Tramways Co.]

Glasgow Corporation Tramways, 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., 1040, Douglas.] *Gen. Manager*, J. Dalrymple; *Traffic Supt.*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Elec. Eng.*, E. T. Goslin; *Sec.*, J. N. Wilson; *Chairman Try. Com.*, ——————; *Vice-Chairman*, Coun. Montgomery.

Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts; *Vice-Chairman*, Coun. C. J. Ramstedt.

Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Coun. J. T. C. Salmon.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 36 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A. Fawcett.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager and Elec. Eng.*, Barnes Kay; *Per. Way Eng.*, J. S. Green (Borough Surveyor); *Chairman Try. Com.*, Coun. Waddington; *Vice-Chairman*, Coun. Haworth.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Eng. and Manager*, H. C. Dufton.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 37.] *Gen. Manager*, J. Stott; *Per. Way Eng.*, J. A. Settle; *Chairman Try. Com.*, Coun. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

Huddersfield Corporation Tramways, Northumberland Street, Huddersfield. [T.N., 698 and 898.] *Gen. Manager & Elec. Eng.*, R. H. Wilkinson; *Assist. Engineer*, A. P. Quilliam; *Traffic Supt.*, T. Hartley; *Borough Eng.*, K. F. Campbell; *Chairman Try. Com.*, Coun. E. H. Sellers; *Vice-Chairman*, Coun. T. Canby.

Hull Corporation Tramways, Alfred Gelder Street, Hull. [T.N., 444, Corporation.] *Manager*, Wm. J. McCombe; *Elec. Eng.*, J. Wilkinson; *Per. Way Eng.*, F. W. Bricknell (*City Engineer*); *Rolling Stock Supt.*, ——————; *Chairman Try. Com.*, Ald. J. H. Hargreaves (Lord Mayor); *Vice-Chairman*, Coun. W. Wheatley.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager*, L. E. Harvey; *Traffic Manager*, A. Woolstencroft; *Works Supt.*, H. H. Simpson; *Chairman Try. Com.*, Coun. W. J. T. Cullis; *Vice-Chairman*, Coun. Owen Waters.

Ilkeston Corporation Tramways, Park Road Ilkeston. [T.A., Bellamy Ilkeston; T.N., 26.] *Manager and Elec. Eng.*, L. C. F. Bellamy; *Chairman Try. Com.*, Coun. J. E. Bestwick; *Vice-Chairman*, Coun. Kane.

Ipswich Corporation Tramways, Constantine Road, Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome; *Vice-Chairman*, W. P. Burton.

Kearsley Urban District Council Tramways, Council Office. Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.

[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, South Street, Keighley. [T.A., Tramways, Keighley; T.N., 17.] *Gen. Manager and Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. A. Smith.

Kilmarnock Corporation Tramways Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, W. C. Bexon; *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com.*, Bailie Jones.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Kirkcaldy Corporation Tramways, Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson.

Leeds City Tramways, Standard Buildings, City Square, Leeds. [T.A., Tramways, Leeds; T.N., 44 and 169; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Per. Way Eng.*, R. B. Holt; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller, & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Judge Hall.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. J. A. Hennah.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Stanley Clegg, Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White; *Vice-Chairman*,

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Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, C. W. Mallins; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *City Electrical Engineer*, Harold Dickinson; *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Coun. E. Russell Taylor; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 62, Finsbury Pavement, London, E.C. [T.A., Lotram, London; T.N., 3321, 3322, and 3323 London Wall.] *Chief Officer*, A. L. C. Fell; *Deputy Chief Officer*, J. K. Bruce; *Elec. Assist.*, J. Shepherd; *Traffic Assist.*, L. Slattery; *Rolling Stock Supt.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, W. J. Squires, J.P.; *Vice-Chairman*, T. Prestige.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett.

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Coun. D. T. J. Lyle; *Vice-Chairman*, Coun. Green.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Coun. F. Goodyear.

Middleton Corporation Tramways. *Consulting Engs.*, Lacey, Sillar, and Leigh; *Chairman Try. Com.*, Ald. W. Wood, J.P. (Mayor); *Vice-Chairman*, Ald. Bentley, J.P.
[Worked by Manchester Corporation Tramways.]

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. R. Mayne; *Vice-Chairman*, Coun. A. M. Sutherland.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 990 L., Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Per. Way Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways. St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis; *Vice-Chairman*, Coun. W. Beale.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain; *Vice-Chairman*, Ald. F. R. Radford.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, J. W. Dugdale; *Traffic Supt.*, J. Brierley; *Chairman Try. Com.*, Ald. F. G. Isherwood; *Vice-Chairman*, Coun. F. Elliot.

Perth Corporation Tramways, Electricity Works, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Calderwood.

Plymouth Corporation Tramways, 15, Ebrington Street, Plymouth. [T.N. 518, Plymouth.] *General Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. S. H. Phillips, J.P.; *Vice-Chairman*, Coun. J. Moon.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Inspector*, W. May; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 110 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson; *Vice-Chairman*, Ald. R. Payne.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Traffic Supt.*, H. Alston; *Chairman, Try. Com.*, Ald. J. Ormrod; *Vice-Chairman*, Coun. T. Parkinson.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Walker Allen, J.P.
[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81 and 85.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. J. W. Stansfield.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P. (Deputy Mayor).

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. Taylor.

Rotherham Corporation Tramways, Rawmarsh Road, Rotherham. [T.A., Cross, Rotherham; T.N., 138, 152, and 241.] *General Manager & Elec. Eng.*, E. Cross; *Deputy Elec. Eng.*, J. Williams; *Traffic Manager*, H. Jagger; *Per. Way Eng.*, E. B. Martin; *Rolling Stock Supt.*, C. A. Walker; *Chairman Try. Com.*, Ald. D. L. Winter; *Vice-Chairman*, Coun. T. Reeves.

St. Helens Corporation Tramways, Town Hall, St. Helens, Lancs. *Chairman Try. Com.*, Ald. Sir J. Beecham; *Vice-Chairman*, Coun. W. N. Pilkington.
[Lines worked by the New St. Helens and District Tramways Co.]

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, H. J. Hawkins; *Traffic Supt.*, W. Blakemore; *Per. Way Supt.*, H. Richardson; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. W. H. Barrett.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Elec. Eng.*, H. E. Yerbury; *Traffic Supt.*, A. Handford; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. Com.*, Ald. Sir W. Clegg, J.P.; *Vice-Chairman*, Coun. A. T. Bescoby, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, ; *Chairman Try. Com.*, H. Pitts.
[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, W. T. Robson; *Boro. Elec. Engineer*, H. F. Street; *Traffic Manager*, G. H. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. Daniells,; *Per. Way Eng.*, E. J. Elford (*Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Ald. A. Martin.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Piermaster*, Capt. N. E. Hucker; *Chairman*, Coun. H. Dowsett.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Ald. Griffiths, J.P.; *Vice-Chairman*, Coun. Clayton.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, H. S. Ellis; *Chairman Try. Com.*, Ald. W. G. Wylie; *Vice-Chairman*, Ald. J. W. Henderson.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Coun. S. C. Homer.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Ald. Chas. Sharples; *Vice-Chairman*, Ald. W. E. Hampett.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Chairman Try. Com.*, Coun. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *Manager*, T. Medcalf; *Elec. Eng.*, A. Dimmack; *Consulting Engs.*, Lacey, Sillar, & Leigh; *Chairman Try. Com.*, Coun. A. D. Richards; *Vice-Chairman*, Coun. A. Bull.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1431, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

Walsall Corporation Tramway, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. Clarke; *Vice-Chairman*, Coun. R. J. Bishop.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Coun. Dr. G. W. Joseph; *Vice-Chairman*, Coun. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Try. Com.*, Ald. A. G. Turley, J.P. (Mayor); *Vice-Chairman*, Coun. G. Garratt.
[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 868 East.] *General Manager*, J. S. D. Moffet; *Boro' Elec. Eng.*, J. W. Beauchamp; *Per. Way Eng.*, J. G. Morley (*Boro. Eng.*); *Chairman Try. Com.*, Ald. H. W. Littler.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Charlton.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *Gen. Manager*, F. Buckley; *Per. Way Eng.*, A. T. Gooseman; *Chairman Try. Com.*, Ald. R. Fletcher; *Vice-Chairman*, Coun. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. W. H. Sessions.

COMPANY TRAMWAYS.

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Manager*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, W. Jackson, Dr. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *Manager and Eng.*, P. H. Marco, A.I.E.E.; *Sec.*, S. M. Wright; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Barrow; T.N., 125.] *Manager*, W. F. Bladon; *Sec.*, T. Phillips-Conn; *Chairman*, H. S. Day; *Directors*, J. V. Kitchener, E. R. Soames.

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, Hon. Sir J. Sivewright, K.C.M.G.; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton, E. Callaird.

Bessbrook and Newry Tramway Company, Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, Robert Caven; *Elec. Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, T. McGreggor Greer.

Birmingham District Power and Traction Company (section of the Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Electrical Eng.*, S. A. Mahood; *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Blackpool and Fleetwood Tramroad Company, Ltd., Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 121.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, John Greenwood; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington, G. Richardson, G. Readman.

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Blackpool, St. Anne's, and Lytham Tramways Company, Ltd., Squires Gate, and 30, Birley Street, Blackpool. [T.N., 327 and 22]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, G. Nicholson; *Directors*, T. M. Smith, T. Preston.

Bray and Enniskerry Railway Company, 52, Westland Row, Dublin. *Sec.*, M. F. Keogh; *Chairman*, A. Killingley; *Director*, F. M'Crea.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, M. H. Volk; *Traffic Superintendent*, H. Sheppard; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, M. Volk; *Directors*, M. H. Volk, B. W. Symonds.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Chas. Challenger; *Assist. Manager*, S. E. Smith; *Electrical Engineer*, W. H. Munton; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, Sir G. White, Bart.; *Directors*, W. G. Verdon Smith (*Managing*), S. White, J.P., J. H. Howell, J.P., G. Stanley White.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. E. Garcke (*chairman*); *Directors*, C. Shirreff B. Hilton, W. L. Madgen, J. S. Raworth, G. T. Symons, C. G. Tegetmeier, P. D. Tuckett, G. Cornwallis West; *Joint Managers*, C. H. Dade and R. J. Howley; *Acting Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.
Barnsley & District.
Barrow-in-Furness.
Birmingham & District Power & Traction Co.:
Birmingham & Midland
Dudley, Stourbridge, & District.
South Staffordshire.
Wolverhampton Dist.
Devonport & District.
Gateshead & District.
General Elec. Tramways.
Gravesend & Northfleet.
Greenock & Port Glasgow.
Jarrow & District.
Kidderminster & District.
Merthyr.
Metropolitan.
Middleton.
North Staffordshire.
Oldham, Ashton, & Hyde.
Peterborough.
Potteries.
Rothesay.
Sheerness & District.
South Metropolitan.
Southport.
Swansea.
Taunton.
Tynemouth & District.
Weston-super-Mare & District.
Worcester.
Wrexham & District.
Yorkshire (Woollen Dist.)

Burton and Ashby Light Railways, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, A. L. Charles; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Douglas Owen.

Carlisle Tramways Company, Ltd., City of, Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, R. L. McCulloch.

Chatham and District Light Railways Company, Luton Road, Chatham, and 83, Cannon Street London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, —— ——; *Traffic Manager*, W. G. Davis; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Directors*, A. H. Beatty (*Chairman*), W. Shearer, H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C. A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, St. George's Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, W. B. H. Martindale, H. C. Levis.

Dartford Urban District Council Tramways, Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Balfour, Beatty, & Co., Ltd., 66, Queen Street, London, E.C. *Gen. Manager and Engineer*, D. N. R. Bruce.

Devonport and District Tramways Company, Tramway Depot., Milehouse, Devonport, and Electrical Federation Offices, London, W.C. [T.A., Head Office, Devonport c/o Tramway, London; T.N., Head Office, Holborn 2686. T.A., Tramways, Milehouse, Devonport; T.N., 62.] *Manager and Eng.*, George Cardwell; *Secretary*, S. M. Wright; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier.

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways, (Lessees: The National Elec. Construction Co., Ltd., 3, Laurence Pountney Hill, London, E.C.) [T.A., Overhauled, London; T.N., 5329 and 5330 Bank.] *Manager*, W. MacGibbon.

Douglas—Ramsey. (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282 and 4006 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart; *Chairman*, J. W. Hill; *Vice-Chairman*, —— ——; *Directors*, E. Anderson, H. B. Coyle.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. M. Harriss; *Elec. Eng.*, H. Tannan; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, W. M. Murphy; *Directors*, W. F. Cotton, J. Mooney.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, W. G. Bond.

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 23, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, J. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager & Engineer*, Daniel Fisher; *Secretary*, E. Cowan; *Chairman*, W. Brownlee; *Directors*, Geo. Balfour, D. W. Wybrants, David Hynds.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A., Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Directors*, H. A. Stagg, C. S. B. Hilton (*deputy chairman*), L. A. Atherley-Jones, K.C., H. S. Day.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, A. Traill; *Directors*, C. M'D. Stuart, J. S. Moore, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, A. W. Bullough; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, National, Gosport, and 16, Municipal, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C [T.N., 958, Gravesend.] *Manager & Sec.*, J. R. Groves; *Chairman*, W. L. Madgen; *Directors*, P. N. Gray, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A. Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, W. F. Herring; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied: *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, E. Valied, J. B. Collings, Q. Le Pelley.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. V. Edwards; *Secretary*, W. R. Elston; *Cons. Engs.*, Kincaid, Waller, Manville, and Dawson; *Chairman*, G. Kitchen; *Directors*, E. C. Morgan, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, W. G. Verdon Smith; *Manager*, F. Freshwater; *Chairman*, Sir George White, Bart.; *Directors*, H. C. Godfray, J. H. Howell, S. White.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, A. L. Gardener; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, W. M. Murphy, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *Managing Eng.*, A. Wray *Secretary*, B. Kingsford; *Chairman*, C. S. B. Hilton; *Directors*, J. A. Lycett (*managing*), S. E. Garcke H. S. Day.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. A. Stanley, M.P.; *Directors*, J. M. Henderson, M.P., Sir J Beecham, J.P., R. Watson, J.P., A. Adam, J. S. Austen

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, W. H. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey J. U. Hodgson, M. H. Maxwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber: *Gen. Manager and Eng.*, A. H. Pott; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, Sir A. H. Stanley, F. V. Schuster.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, A. E. Wray.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Mansfield & District Light Railway Co., Sutton Road, Mansfield. [T.A., Cars, Mansfield; T.N., 107.] *Gen. Manager and Sec.*, C. R. Walker; *Chairman*, A. R. Holland; *Directors*, W. I. Chadburn A. H. Beatty, G. Balfour.

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, C. A. Huni; *Chairman*, Col. Sir A. Griffith Boscawen; *Directors*, Sir W. H. Vaudrey, B. E. Greenwell, E. Schenk.

Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Traffic Supt.*, H. King; *Sec.*, S. J. Clements, *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

Metropolitan Electric Tramways, Limited, Electric Railway House, Broadway, Westminster, London, S.W. [T.A., Metrolito, London; T.N., 6800, Victoria.] Manor House Offices, Seven Sisters Road, N. [T.A., Lenticscus, London; T.N., 77 Tottenham.] *Gen. Manager and Eng.*, A. H. Pott; *Traffic Manager*, W. E. Hammond; *Secretary*, A. L. Barber; *Chairman*, E. Garcke; *Directors*, Sir E. Spencer, W. L. Madgen, C. G. Tegetmeier, J. Devonshire (*Managing Director*).

Mexborough and Swinton Tramways Company, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 3, Laurence Pountney Hill, Cannon Street, London, E.C. *Manager and Eng.*, P. Priestly; *Cons. Elec. Eng.*, F. E. Stanley; *Commercial Manager*, Wm. T. Mitchell; *Traffic Supt.*, M. McLeod; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Director* (*Managing*), W. B. Cownie, C.A.

Middlesbro, Stockton, and Thornaby Electric Tramway, Bridge Road, Stockton-on-Tees, and Clare Street House, Bristol. [T.A., Tramways, Stockton; T.N., 129.] *Manager*, F. Freshwater; *Secretary*, W. G. Verdon Smith; *Chairman*, Sir Geo. White, Bart.; *Directors*, H. C. Godfray, S. White, H. C. Doggett.

Middleton Electric Traction Company, Hiltonfold Lane, Middleton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depot, Middleton; T.N., 37 Middleton.] *Gen. Manager*, W. F. Endean; *Secretary*, W. E. Woodroofe; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreathall.

Musselburgh and District Electric Light and Traction Co., Ltd., High St., Musselburgh, N.B. [T.A., Tramways, Musselburgh; T.N., 115.] (Registered Office, 3, Laurence Pountney Hill, London, E.C. [T.N., 5329 and 5330, Bank.]) *Manager*, R. Watson; *Resident Engineer*, J. L. Winter; *Traffic Inspector*, W. Scott; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, B. Burnham, J. Anderson, W. B. Cownie.

New General Traction Company, Ltd., 8, Crosby Square, London, E.C. *Managing Director*, E. A. Hopkins; *Secretary*, J. G. Mills; *Chief Engineer*, I. E. Winslow; *Chairman*, Baron E. B. d'Erlanger. [This company controls the Norwich and the Douglas Southern Electric Tramways Companies.]

New St. Helens and District Tramways Company, Ltd., Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36 Atherton.] *Engineer and Manager*, C. D. Stanley; *Secretary*, H. P. Conibear; *Chairman*, Hon. Arthur Stanley, M.P.; *Directors*, J. Hunter, J.P., H. Martin, J.P., J. M. Henderson, M.P., J. S. Austen, and E. H. Edwardes (*Managing*).

North Shields Tramway Company owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

Norwich Electric Tramway Company, 5, Orford Hill, Norwich, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, F. W. Ketley; *Consulting Eng.*, I. E. Winslow; *Sec.*, J. G. Mills; *Chairman*, Baron E. B. d'Erlanger; *Directors*, E. A. Hopkins, Hon. A. G. Brand, F. FitzGerald, G. M. Chamberlin, and C. Pakeman.

Nottinghamshire and Derbyshire Tramways Company, Tramway Depot, Langley Mill, Derbyshire, and 66, Queen Street, London, E.C. [T.A., Tramways, Langley Mill; T.N., 53, Langley Mill.] *Manager*, C. R. Walker; *Secretary*, Wm. C. Bryden; *Directors*, A. R. Holland, A. H. Beatty, A. V. Anderson, and M. A. Edwards.

Oldham, Ashton and Hyde Electric Tramway, Ltd., Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Denton; T.N., 265 Ashton.] *Supt.*, A. Anderson; *Secretary*, W. E. Woodroofe; *Chairman*, E. Garcke; *Directors*, L. A. Atherley Jones, K.C., R. Whittaker, W. S. Wreathall, J. V. Kitchener (*Managing Director.*)

Paisley District Tramways Company, Tramway Depôt, Paisley, and 83, Cannon Street, London, E.C. [T.N., 218 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Lord Arthur Butler, D. Johnston Smith, John Young.

Peterborough Electric Traction Company, Ltd., Lincoln Road, Peterborough, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Peterborough; T.N., 224.] *Gen. Manager*, T. G. Clabburn; *Secretary*, S. M. Wright; *Chairman*, Lord Vaux of Harrowden; *Director*, E. A. Paris.

Plymouth, Stonehouse and Devonport Tramways Co., 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. [T.N. 53.] *Manager*, G. H. Moreton; *Elec. Eng.*, J. Graham Pearce; *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*).

Portsdown and Horndean Light Railway, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., Municipal 16 and Nat. 3, Gosport.] *Engineer and Manager*, J. Feredav Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern.

Potteries Electric Traction Company. Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Stoke-on-Trent; T.N., 801.] *Gen. Manager and Eng.*, W. Thom; *Power and Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, W. F. Herring; *Chairman*, G. Cornwallis-West; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

Rhondda Tramways Company, Ltd., Tramway Depot, Porth, Rhondda, and Laurence Pountney Hill, Cannon Street, London, E.C. [T.A., Tramway, Porth; T.N., 8.] *Manager and Engineer*, H. Holliday; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, H. T. Barnett.

Rothesay Tramways Company, Ltd., Point House, Rothesay, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, A. Robertson; *Elec. Eng.*, H. H. Hill; *Sec.*, W. F. Herring; *Chairman*, A. C. Miles; *Directors*, W. L. Madgen, H. S. Day.

Ryde Pier Company, Ryde, Isle of Wight. *Manager*, W. D. Stanney; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

Scarborough Tramways Company, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, J. V. Moinet; *Chairman*, F. E. Gripper; *Directors*, V. Fowler, M. T. Whittaker, J. C. Wigham.

Sheerness and District Electric Power and Traction Company, Ltd., Electricity Works, Sheerness East, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Sheerness; T.N., 45.] *Manager & Eng.*, C. W. Durnford; *Sec.*, P. N. Gray; *Chairman*, G. J. Somerville; *Directors*, R. J. Howley, E. R. Soames.

Snaefell Mountain Railway (See Manx Electric Railway Company).

South Metropolitan Electric Tramways and Lighting Company, Ltd., 114, Church Street, Croydon, 30, High Street, Sutton, and Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 304 Croydon, 14 Sutton and 6800, Victoria.] *Gen. Manager and Engineer*, A. V. Mason; *Supt.*, A. E. Wray; *Secretary*, W. M. Wright; *Chairman*, C. G. Tegetmeier; *Directors*, J. Devonshire, E. Garcke.

Southport Pier Co., Ltd., Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, W. H. Scott; *Chairman*, A. Skinner; *Directors*, I. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

Southport Tramways Company, Ltd., The Depôt, Churchtown, Southport, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, J. Lloyd; *Secretary*, H. A. Stagg; *Chairman*, C. S. Hilton; *Directors*, J. S. Raworth, Lord Vaux of Harrowden, J. V. Kitchener.

South Staffordshire Tramways (Lessee) Company, Ltd., Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, W. S. Schuster; *Directors*, J. A. Lycett, S. R. Blundstone, W. G. Bond, B. Kingsford.

Sunderland District Electric Tramways. Ltd., Fence Houses, co. Durham. [T.A., Trams, Philadelphia, Shiney Row; T.N., 21, Houghton-le-Spring.] *Resident Manager and Engineer*, G. Stratton; *Traffic Manager*, E. A. Pearman; *Secretary*, H. J. Almond; *Directors*, H. R. Hogg, Hon. R. Parker, R. Tayler.

Sutton and Howth Electric Tramway Company (owned by the Great Northern Railway, Ireland), Sutton, county Dublin, and Amiens Street Terminus, Dublin. [T.A., Railroad, Dublin; T.N., 171, Dublin, and 16 Sutton.] *Gen. Manager*, John Bagwell; *Elec. Eng.*, A. W. Whieldon; *Supt. of Line*, R. J. Moore; *Chief Eng.* F. A. Campion; *Locomotive Supt.*, G. T. Glover; *Sec.*, T. Morrison; *Chairman*, F. Vernon; *Directors*, W. P. Cairnes (*Deputy Chairman*), Sir W. Q. Ewart, Bart., W. B. Carson, H. S. Guinness, J. T. Reade, W. L. A. Goulding, Major J. C. W. Madden, R. A. Gradwell, J. Milne Barbour, T. F. Cooke, W. H. B. Moorhead, Lt.-Col. H. Plews.

Swansea Improvements and Tramways Company, 2, Rutland St., Swansea, and Electrical Federation Offices. Kingsway, London, W.C. [T.A., Tramway, Swansea; T.N., 268 Swansea.] *Gen. Manager*, D. James; *Elec. Eng.*, A. Johnston; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, G. J. Somerville, S. E. Garcke.

Taunton Electric Traction Company, Ltd., East Reach, Taunton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Taunton, c/o "Tramways," London.] *Manager*, B. H. Griffith; *Secretary*, S. M. Wright; *Chairman*, G. J. Somerville; *Directors*, E. Garcke.

Torquay Tramways Co., Ltd., St. Marychurch Road, Torquay. [T.A., Carsheds, Torquay; T.N., 167 Torquay.] *Registered Office*, 3, Laurence Pountney Hill, Cannon Street, E.C. *Manager and Eng.*, H. J. Nisbett; *Secretary*, L. D. H. Jacobs; *Managing Director*, W. B. Cownie.

Trafford Park Company (Tramways), Trafford Park, Manchester. [T.A., Developing, Manchester; T.N., 61, Trafford Park.] *Secretary*, C. A. Grundy; *Chairman*, Marshall Stevens; *Directors*, Sir J. Lyons, H. McNiel.

[Lines worked by the Manchester and Salford Corporations.]

Tynemouth and District Electric Traction Company, Limited, John Street, Cullercoats, Northumberland, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tram Co., Cullercoats; T.N., 17 Whitley.] *Gen. Manager*, H. J. Smith; *Sec.*, C. W. Francis; *Chairman*, H. S. Day; *Directors*, J. H. Robinson, J. B. Williamson, R. J. Howley Geo. J. Somerville.

Tyneside Tramways and Tramroad Company, Ltd., Neptune Bank, Wallsend. [T.A., Tramways, Wallsend; T.N., 84.] *Secretary & Res. Manager*, J. C. Little; *Elec. Eng.*, F. H. Briggs; *Cons. Eng.*, W. McLellan; *Chairman*, J. T. Merz; *Directors*, Lord Armstrong, J. H. Armstrong, G. E. Henderson, S. Hunter.

Wakefield and District Light Railway Company, Belle Isle, Wakefield.

[This company has been amalgamated with the Yorkshire (West Riding) Electric Tramways Co., Ltd.]

Walton-on-the-Naze Pier Tramway (Coast Development Corporation, Ltd.), The Pier, Walton-on-the-Naze. [T.A., Electricity Works, Walton-on-Naze.] *Eng.*, E. A. Lambert, A.M.I.E.E.; *Sec.*, J. F. Stovell; *Chairman*, — Hallett; *Directors*, Sir T. Sturmey Cave P. Denny, G. Mitchell, G. Riley, H. R. Spence (*Managing*).

Wemyss and District Tramways Company, Ltd., Car Depot, Aberhill, Methill, N.B. [T.A., Tramways, Methill; T.N., 38 Leven.] *Gen. Manager*, W. T. Dawson; *Sec.*, J. O. Shepherd; *Chairman*, G. Balfour; *Directors*, W. Shepherd, G. Balfour, J. H. Guild.

Weston-super-Mare and District Electric Supply Co., Ltd., Locking Road, Weston-super-Mare, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Weston-s.-Mare; T.N., 79 & 181.] *Manager and Elec. Eng.*, G. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, E. R. Soames.

Wolverhampton Electric Tramways, Limited, Tramway Depot, Bilston, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Bilston; T.N., 56, Bilston.] *General Manager*, W. G. Bond; *Sec.*, C. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, W. G. Bond, B. Kingsford.

Worcester Electric Traction Company, Ltd., St. John's, Worcester, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Worcester; T.N., 81.] *Engineering Manager*, R. Simpson; *Secretary*, C. W. Francis; *Chairman*, H. S. Day; *Directors*, J. A. Lycett, C. S. B. Hilton, S. E. Garcke.

Wrexham and District Electric Tramways Limited, 6, Lord Street, Wrexham, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Wrexham; T.N., 182, Wrexham.] *Manager*, A. A. Hawkins; *Sec.*, W. E. Bennett; *Chairman*, J. V. Kitchener; *Directors*, G. J. Somerville, W. S. Wreathall.

Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. [T.A., England, Belle Isle, Wakefield; T.N., 213.] *Gen. Manager and Sec.*, H. England; *Elec. Engs.*, C. J. Jewell and E. A. Wood; *Traffic Supt.*, W. Wilde; *Chairman*, Sir Herbert S. Leon, Bart.; *Directors*, E. Schenk, B. Newgass, G. E. Leon.

Yorkshire (Woollen District) Electric Tramways. Limited, Frost Hill, Liversedge, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Heckmondwike; T.N., 8 Heckmondwike.] *Secretary*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Sir Thos. Pilkington, E. A. Paris (*managing*).

TRAMWAY ASSOCIATIONS.

MUNICIPAL TRAMWAYS ASSOCIATION.

President:
PETER FISHER
(General Manager, Dundee Corporation Tramways).

Vice-President:
HENRY MOZLEY
(General Manager, Burnley Corporation Tramways).

Hon. Secretary and Treasurer:
C. J. SPENCER
(General Manager, Bradford Corporation Tramways), 7, Hall Ings, Bradford.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

President:
The Rt. Hon. VISCOUNT CHILSTON.

Chairman:
The Hon. ARTHUR STANLEY, M.P.

Vice-Chairman:
HARRY ENGLAND.

Hon. Solicitor: W. MORRIS, Junr.

Hon. Auditor: A. W. CHAMBERS, A.S.A.A.

Secretary:
A. DE TURCKHEIM.

Offices: Caxton House, Westminster, London, S.W. Telephone No. 2110 Victoria.

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LIST OF ELECTRIC TRAMWAYS & RAILWAYS.

PARTICULARS OF TRACK AND EQUIPMENT.

TRAMWAYS, pp. xxvii-xxx. RAILWAYS, p. xxx.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No of Motor Cars.	No of Dynamos	No. of Engines	Type of Engines	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS.				ft. in.	lbs.	1 in	ft. rad.						
Aberdare Urban District Trys. ..	Oct., 1913	2·9	3·3	3 6	96 G	13	45	10	2	2	V. Cp. C.	400	Lanc. Dynamo Co.
Aberdeen Corporation	Dec., 1899	14·4	27·75	4 8½	96 G	13	42·5	83	*14	14	V. Cp. C.	4,610	British T-H. Macartney & Co.
Aberdeen Suburban Trys. Co. ..	June, 1905	5	5	4 8½	95 G	28	90	9	..	..	..	..	J. G. White & Co. Brush Co.
Accrington Corporation	Aug., 1907	7	10·66	4 0	95 G	14	..	27	*8	8	..	1,888	Brush Co.
Airdrie & Coatbridge Tramway Co.	Feb., 1904	3·63	4·94	4 8½	94 G	14	210	15	..	..	..	..	Brush Co.
Ashton-under-Lyne Corporation ..	Aug., 1902	7	8·15	4 8½	96 G	10	40	25	5	5	..	400	Dick, Kerr, & Co. Siemens Bros.
Ayr Corporation	Sept., 1901	6	7·612	4 8½	90 G	21	45	22	*8	8	..	400	British T-H.
Barking Town Urban District ..	Dec., 1903	2·6	3·125	4 8½	100 G	25	44	9	4	3	V. Cp. C.	..	Blackwell & Co.
Barnsley & Dist. Elec. Traction Co.	Nov., 1902	3·06	4·25	4 8½	97 G	10	60	13	*6	6	..	..	J. G. White & Co. Brush Co.
Barrow-in-Furness	Feb., 1904	5·37	8·25	4 0	90 G	13	50	16	*8	..	..	..	Brush Co. Dick, Kerr, & Co
Bath Electric Tramways, Ltd. ..	Jan., 1904	14·7	19·3	4 8½	95 G	10·7	38	40	4	4	H.T. Cp.	675	Westinghouse
Batley Corporation	Oct., 1903	6·536	10·47	4 8½	104 G	9	40	15	4	4	..	..	B. I. W. Co. British Elc. Cr. Co
Belfast City	Dec., 1905	49·65	98·54	4 8½	105 G	15	35	290	3	3	Tri. Exp.	3,000	J. G. White & Co. Westinghouse
Bessbrook—Newry (1) .. .. Bessbrook and Newry Try. Co.	Oct., 1885	3	3	3 0	41 V	80	55	2	2	1	Hyd. Turb.	..	Mather & Platt
Bexley Urban District	Oct., 1903	5·25	6·5	4 8½	90 G	14	40	16	2	2	V. Cp.	..	Dick, Kerr, & Co.
Birkenhead Corporation	Feb., 1901	13·8	24·09	4 8½	100 G	13½	40	65	6	6	V. Cp.	..	Blackwell & Co. British T-H.
Birmingham Corporation	Jan., 1904	65·56	114·55	3 6	105 G	13	40	550	..	..	..	1,475	Dick, Kerr, & Co.
Birmingham and Midland Trys. Co.	July, 1904	12·20	18·8	3 6	85 & 94 G	15	31	62	6	6	Cp.	..	Brush Co.
Blackburn Corporation	March, 1899	14·67	24·75	4 0	92 G	15	30	61	*4	4	V. Cp. C.	..	British T-H. Blackwell & Co.
Blackpool Corporation	Oct., 1885	14·75	21·38	4 8½	96 G	20	36	84	..	..	Stm. Turb.	600	Elwell-Parker British T-H.
Blackpool & Fleetwood Tramrd. Co.	July, 1898	7·9	15	4 8½	56 & 70 V / 98 G	26	80	37	5	5	V. Cp.	600	Mather & Platt D.K. & Co.-B.T-H.
Blackpool and Fylde Light Ry. Co.	Under cons.	14	14·5	4 8½	..	..	..	..	..	..	..	..	
Blackpool—St. Anne's & Lytham ..	May, 1903	7·47	14·03	4 8½	92 G	22	35	40	..	..	..	..	British T-H.
Bolton Corporation	Nov., 1899	26	47·21	4 8½	90 G	14	35	112	*12	12	V. Cp. C.	3,800	Dick, Kerr, & Co Blackwell & Co.
Bootle Corporation	May, 1900	4·125	7·75	4 8½	95 G	20	40	55	8	8	..	..	Blackwell & Co.
Bournemouth Corporation	July, 1902	22	29·77	3 6	100 G / 66 slot	10	40	81	4	4	Cp.	1,500	J. G. White & Co.
Bradford Corporation	July, 1898	54·8	103·86	4 0	102 G	9·8	40	252	11	11	V. Cp. C.	..	Westinghouse Blackwell & Co.
Bray and Enniskerry Railway Co.	Under cons.	3·25	5	3 6	..	..	..	..	..	..	..	..	Macartney & Co.
Brighton Corporation	Nov., 1901	9·48	17·18	3 6	101 G	9	40	53	5	5	Stm. Turb.	1,000	Westinghouse Blackwell & Co.
Brighton Beach (1)	Aug., 1883	1·75	2	2 8½	35 V	100	80	8	2	1	Gas	..	Siemens Bros.
Bristol—Bristol Trys. Co.	Oct., 1895	31	57·5	4 8½	92½ G	10	30	232	6	4	V. Cp. C.	..	British T-H. and Blackwell & Co.
Burnley Corporation	Dec., 1901	11·9	22·16	4 0	102 & 107 G	9·8	35	67	*8	8	H. Cp. C.	750	British T-H.
Burton and Ashby Light Railway ..	July, 1906	10·2	12·3	3 6	90 G	11	51	20	2	2	Diesel	330	Dick, Kerr & Co. Brush Co.
Burton-on-Trent Corporation ..	Aug., 1903	6·67	9·75	3 6	90 G	11·7	40	20	4	3	V. Cp.	400	Dick, Kerr, & Co. Blackwell & Co.
Bury Corporation	June, 1903	22·5	34·42	4 8½	102¾ G	12	40	54	6	6	..	1,500	Westinghouse
Camborne and Redruth	Nov., 1902	3·75	4	3 6	83 G	15	40	8	7	7	Cp.	1,525	Dick, Kerr, & Co. British T-H.
Cardiff Corporation	May, 1902	17·25	31·82	4 8½	100 G	23	35	130	9	9	V. Cp. C.	2,200	British T-H. Dick, Kerr, & Co.
Carlisle, City of, Elec. Try. Co. ..	June, 1900	7·25	8·5	3 6	83 G	14	23	15	4	4	..	..	D.K. & Co.-B.T-H.
Cavehill & Whitewell Try. Co...	Feb., 1906	3·29	4·31	4 9	105 G	31	75	10	..	..	..	..	J. G. White & Co.
Chatham & District Light Rly. Co.	June, 1902	14·98	26	3 6	92½ & 105 G	9	35	50	5	4	H. Cp.	675	British T-H. Co. Brush Co.
Cheltenham and District ..	Aug., 1901	10·22	12·25	3 6	80 & 90 G	8·9	37	20	2	2	V. Cp.	..	Westinghouse
Chester Corporation	April, 1903	3·51	6·3	3 6	94 & 100 G	30	40	18	*7	7	V. Cp. C.	240	Blackwell & Co. British T-H.
Chesterfield Corporation	Dec., 1904	3·6	5·1	4 8½	96 & / 101 G	20	40	17	4	4	V. Cp. C.	800	Milnes & Co. Westinghouse Brush
Clontarf and Hill of Howth ..	July, 1900	5·5	6·5	5 3	90 & 60 G	13	34	12	..	..	..	..	W. M. Murphy & Co.
Colchester Corporation	July, 1904	6	7·94	3 6	95 G	12	43	18	8	8	V. Cp.	1,140	Dick, Kerr & Co. J. G. White & Co.
Colne Corporation Tramways ..	Nov., 1903	5·2	6·7	4 0	102 G	13	60	12	*	..	..	..	Blackwell & B.T-H. Glover & Co.
Cork Elec. Try. & Lighting Co. ..	Dec., 1898	10	15	2 11½	83 G	14	26	35	*9	9	H. Cp. C.	1,450	British T-H. Blackwell & Co.
Coventry Corporation Tramways ..	Dec., 1895	13·25	15·40	3 6	65 G / 81 G	16	35	46	5	5	H. & V. Cp.	700	Westinghouse Blackwell & Co.
Croydon Corporation	Sept., 1901	11	19·12	4 8½	96·5 G	16	40	75	*13	13	..	2,000	British T-H. Co.
Darlington Corporation	June, 1904	4·875	8·88	3 6	90 G	14	46	18	9	7	..	..	Westinghouse

* Current from combined lighting and traction station. (1) Third rail system. † Includes 1·25 miles railless trolley line.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars	No. of Dynamos	No. of Engines.	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Dartford U. D. C.	Feb., 1906	6·5	8·5	4 8½	100 G	12	35	12	4	..	..	..	British I. W.
Darwen Corporation	Oct., 1900	4·36	7·16	4 0	95 G	9	35	17	*4	4	H. Cp.	..	British T-H.
Derby and Ashbourne	..	14·5	..	4 8½									J. G. White & Co.
Derby Corporation	July, 1904	13	22·06	4 0	95 G	14	46	50	3	3	Stm. Turb.	..	Brush & B.T-H.
Devonport & District Try. Co., Ltd.	June, 1901	8·85	15·79	3 6	92 G	11	35	25	*	..	..	..	Blackwell & B.T-H.
Devonport Corporation	June, 1901	..	7	3 6	97 G	10	50	12	..	..	..	..	Blackwell & Co.
Doncaster Corporation	June, 1902	8·25	12·52	4 8½	94 G	16	45	32	8	8	..	1,000	Blackwell & Co.
Dover Corporation	Sept., 1897	4·75	7	3 6	87 & 90 G	10	44	21	*2	2	H.CC.	..	D. K. & B.-T-H.
Douglas—Port Soderick .. Douglas Southern Elec. Trys. Co.	Aug., 1896	3·25	3·75	4 8½	65 V	12	45	8	2	2	H. Cp.	200	Westinghouse British T-H.
Dublin & Lucan Elec. Railway Co.	March, 1900	6·5	7	3 6	50 V	20	27	16	2	2	H. Cp. C.	240	Dick, Kerr, & Co.
Dublin United Tramways Co.	May, 1896	49·8	95·26	5 3	105 G	12·3	22	365	8	7	V. Cp. C.	4,300	Dick, Kerr, & Co. Blackwell & Co. British T-H.
Dudley and Stourbridge Trys. British Electric Traction Co.	July, 1899	21·25	27·25	3 6	90 G	11	50	59	4	4	H. Cp.	..	British T-H. Blackwell & Co.
Dumbarton	Feb., 1907	13	17	4 7½	90 & 96	14	60	26	3	3	..	..	Dick, Kerr, & Co.
Dundalk	Under cons.	6	6·25	3 6	97 G	10	50	12					White & B.T-H.
Dundee, Broughty Ferry, and District	Dec., 1905	5	9·125	4 8½	90 G	16·5	30½	14	3	3	V. Cp. C.	..	J. G. White & Co. British T-H. Co.
Dundee Corporation	July, 1900	15·5	27·47	4 8½	90 & 100 G	10	35	72	5	5	..	..	Blackwell & Co.
Dunfermline (Fife Try. & Power Co.)	Nov., 1909	14·6	17·4	..	90 G	10	25	28	2	2	..	..	British T-H.
East Ham Corporation	June, 1901	7·26	14·34	4 8½	90 & 105 G	25	40	45	5	5	H. Cp.	500	Dick, Kerr, & Co.
Eccles Corporation	May, 1902	5	7·75	4 8½	100 G	..	..	..	..	..	..	..	
Edinburgh and District	June, 1910	1·25	1·5	4 8½	100 G	21	54	4	..	..	..	..	Dick, Kerr, & Co.
Erith Urban District Council	Aug., 1905	4·7	8·4	4 8½	100 G	17	40	17	3	5	..	..	Brush Co.
Exeter Corporation	April, 1905	4·875	7	3 6	90 G	11·5	35	20	*4	4	H. Cp.	..	Westinghouse Co. Dick, Kerr, & Co.
Falkirk and District	Oct. 1905	7·81	10·5	4 0	90 G.	11·3	48	18	*	..	..	..	Bruce Peebles & Co. British T-H.
Farnworth Urban District	Jan., 1902	4·33	7·16	4 8½	98 G	29	36	13	4	4	..	..	
Felixstowe Pier	Aug., 1905	0·5	0·5	3 6	36	..	..	3	..	..	..	..	
Gateshead and District	May, 1901	11·25	17·30	4 8½	90 G	8	35	53	*	..	..	..	Dick, Kerr, & Co. Blackwell & Co.
Giant's Causeway Elec. Try. Co.	Sept., 1883	8	9	3 0	42 V / 75 G	24	30	26	2	2	Hyd. Turb.	..	Siemens Bros. British T-H.
Glasgow Corporation	Oct., 1898	98·18	196·23	4 7½	110 G	11·93	30¾	856	7	7	V. Cp.	14,200	British T-H. Westinghouse
Glossop Urban District	Aug., 1903	4·56	5·6	4 8½	90 G	13	40	8	4	4	V. Cp.	200	British T-H.
Gloucester Corporation Light Rly.	May, 1904	9	15	3 6	90 G	25	40	30	*2	2	Cp.	750	Brush Co. Dick, Kerr, & Co
Gosport & Fareham Trys. Co.	Jan., 1906	7·5	11·5	4 7½	96 G	16	37½	22	3	3	V. Cp. C.	750	Dick, Kerr, & Co. Brush Co.
Gravesend and Northfleet	Aug., 1902	6·5	9	4 8½	87 G	11	45	18	*				
Great Crosby	June, 1900	2·5	2·5	4 8½	92½ G	..	40	14	*7	7	H. & V. Cp.	160	Dick, Kerr, & Co. Blackwell & Co.
Great Grimsby	Dec., 1901	6	11	4 8½	90 G	15	26	38	2	2	..	300	Dick, Kerr, & Co.
Greenock and Port Glasgow	Oct., 1901	7·425	14·05	4 7½	90 G	11	60	42	*				
Guernsey Railway Co.	Nov., 1892	3	3	3 8½	40 & 74 V / 84 G	60	60	18	2	2	H. & V. Cp.	160	Siemens Bros. British T-H.
Halifax Corporation	June, 1898	37·4	54·88	3 6	95½ G	9·5	38·6	101	*9	9	H. & V. Cp.	2,500	Electric Cons. Co. British T-H.
Hampshire Light Railway (Elec.) Co.	March, 1903	6	9	4 8½	..		..	10	*				
Hartlepool Electric Tramways Co.	May, 1896	6·72	8·3	3 6	87 & 90 G	15	35	21	4	4	V. Cp.	..	Electric Cons. Co. Dick, Kerr, & Co.
Haslingden Corporation	July, 1908	3	3	4 0	100 G	10	30	..	..	..	..	..	Dick, Kerr, & Co.
Hastings and District	July, 1905	19·33	34	3 6	90 G	8	36·75	65	6	6	V. Cp.	2,100	Dick, Kerr, & Co.
Herne Bay Pier (1)	March, 1899	·75	·75	3 0	60	..	..	3	1	1	Gas	50	British T-H.
Heywood Corporation	Dec., 1905	4·25	4·25	4 8½	90 G	17	..	..	3	3	..	..	Blackwell & Co. B.I. & H.C. Co.
Houghton-le-Spring (See Sunderland Dist. Elec. Trys.)													
Huddersfield Corporation	Feb., 1901	31·07	48·5	4 7½	98 G	11	35	96	4	4	V. Cp. C.	2,200	British T-H.
Hull Corporation	July, 1899	13·46	30·5	4 8½	94 G	20	30	180	7	7	V. Cp. C.	2,560	British T-H. Westinghouse
Ilford Urban District	Mar., 1903	6·5	11·35	4 8½	95 G	13	33·3	26	*7	7	..	1,600	British T-H. Dick, Kerr, & Co.
Ilkeston Corporation	May, 1903	3·8	4·3	3 6	90 G	12	28	13	2	1	..	..	Dick, Kerr, & Co.
Ipswich Corporation	Nov., 1903	10·8	14·87	3 6	90 G	11·5	40	36	10	10	Enclos'd	1,175	Westinghouse
Isle of Man— Manx Elc. Douglas to Ramsey	July, 1893	18	35·75	3 0	62½ V	24	90	65	9	9	H. Cp.	1 300	Mather & Platt
Rly. Co. Snaefell Mountain	Aug., 1895	4·5	9·5	3 6	56 V	12	90						
Isle of Thanet Trys. & Ltg. Co.	April, 1901	11	20·67	3 6	90 G	11	38	59	*6	6	3 V. Cp. / 3 H. Cp.	800	British T-H. Blackwell & Co.
Jarrow and District	Nov., 1906	2·54	3·42	4 8½	95 G	12·5	50	10	..	..	..	..	Brush Co. B.I. & H.C. Co.
Kearsley Urban District	Jan., 1902	1·75	1·75	4 8½	95 G	20	..	..	..	..	..	..	Westinghouse
Keighley Corporation	Oct., 1904	3·5	6·11	4 0	95 G	25	60	12	*4	4	V.	200	Blackwell & Co. Brush & B.T-H.
Kidderminster—Stourport British Electric Traction Co.	May, 1898	4·6	4·87	3 6	75 G	14	45	13	*5	5	Stm Turb.	..	Brush Elc. Eg. Co.
Kilmarnock Corporation	Dec., 1904	4·18	5·5	4 8½	90 G	24	45	14	*3	3	..	250	Blackwell & Co.
King's Norton & Northfield U. D.	May, 1904	5·25	8·25	3 6	105 G	15&21	100&145	..	..	..	..	..	Blackwell & Co.
Kinver	April, 1901	4	4	3 6	63 & 90 G	..	..	6					
Kirkcaldy Corporation	Feb., 1903	6·11	8·56	3 6	100 G	11	40	22	*8	6	Cp. H.S.	1,090	British T-H. Co.
Lanarkshire Tramway Co.	July, 1903	21·21	34·4	4 7½	96 & 101 G	9·4	37	60	4	4	3 H. Cp. / 1 V. Cp.	825	British T-H. Co.
Lancashire United Tramways Co.	Oct., 1902	39	54	4 8½	90 G	15	50	82	*5	5	V. Cp. C.	2,750	B. I. W. Co.
Lancaster Corporation	Jan., 1903	4	4·81	4 8½	90 G	8	30	12	4	4	V. Cp.	200	Greenwood & Batley, Ltd.
Leamington & Warwick Elec. T. Co.	July, 1905	3·04	6·1	3 6	65 G	12	47	12	3	3	Cp.	..	Brush Co.
Leeds City	Aug., 1897	69·02	114·62	4 8½	105 & 111 G	8·4	32	345	5 / 3	5 / 3	H. Cp. C. / Stm. Tur	6,150	Elec. Con. Co. Greenwood & Batley, British T-H. Blackwell & Co.

* Current from combined lighting and traction station. (1) Third Rail system.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Leicester Corporation	May, 1904	20	37	4 8½	100 G	16	35	160	4	4	V. Cp.C.	2,500	Dick, Kerr, & Co. / Blackwell & Co.
Leith Corporation	Aug., 1905	9·08	17·9	4 8½	106·7 G	19	54	37	*11	11	..	1,600	Brush & B.T-H.
Leyton Urban District	Dec., 1906	9·125	18·5	4 8½	105 & 111 G	24	45	60	*8	8	Cp.	1,600	..
Lincoln Corporation (1)	Nov., 1905	1·75	2·96	4 8½	100 G	..	..	8	*8	8	..	645	Blackwell & Co.
Liverpool Corporation	Nov., 1898	63	119	4 8½	95 & 98 G	13	40	596	*55	55	V. Cp. Trip Exp	35,300	Blackwell & Co. / British T-H. / Dick, Kerr, & Co. / Westinghouse
Liverpool Overh'd Ry. (Trol. Ln. Ex.)	June, 1900	2·5	2·5	4 8½	92½ G	Nil	40	14	7	7	H. & V. Cp.	160	Dick, Kerr, & Co.
Llandudno and Colwyn Bay ..	Oct., 1907	6·60	7·573	3 6	90 G	11·5	45	18	*	..	..	..	Bruce Peebles & Co.
Llanelly and District	July, 1911	6·25	6·75	4 8½	90 G	..	..	10	*2	2	Trip. Ex.	..	British T-H.
London County Council (2) ..	May, 1903	142·98	279·3	4 8½	105 G	11	45	1730	..	..	V. Cp. C, Turbine	..	Dick, Kerr, & Co. / Westinghouse
London United Tramways Co. ..	April, 1901	55·25	102·45	4 8½	92½ & 100 G	18	28	339	7	5	V. Cp.	3,500	British T-H. / Westinghouse. / Blackwell & Co.
Lowestoft Corporation	July, 1903	4·75	5·07	3 6	100 G	27	36	19	*5	5	Cp.	..	Blackwell & Co.
Luton Corporation Tramways (Leased to J. G. White & Co., Ltd.) ..	Feb., 1908	5·25	6·25	4 8½	95 G	11	35	12	*1	1	..	..	J. G. White & Co. / British T-H.
Maidstone Corporation	July, 1904	5·5	7·04	3 6½	96 G	9	35	19	6	6	..	300	Dick, Kerr & Co.
Manchester Corporation	June, 1901	119·76	202·7	4 8½	105 G	14·9	35	683	*22	22	Turb'nes	45,300	British T-H. / Dick, Kerr, & Co.
Mansfield and District Co. ..	July, 1905	10	12·25	4 8½	90 G	17	50	20	*3	3	..	..	
Merthyr	April, 1901	2·98	3·94	3 6	96 G	11	66	16	*4	4	H.S.V.	..	D. K. & B. T-H
Metropolitan Electric Trys., Ltd.	July, 1904	52·5	105	4 8½	100 G	12	40	312	5	5	1 Stm. Tur	..	British T-H. / Brush Co.
Mexborough & Swinton Trys. Co.	Feb., 1907	7·75	10·75	4 8½	90 G	8·5	55	20	3	3	..	1,300	Brush & B.T-H.
Middlesbro', Stockton, & Thornaby Electric Tramways Co.	July, 1898	10·5	15·825	3 6	92½ G	17	35	60	3	4	H. & V. Cp.	900	British T-H. / Blackwell & Co.
Middlesex County Council	Aug., 1904	25·5	51	4 8½	..	..	..	..	..	..	..	..	
Middleton Corporation	March, 1902	2·5	5	4 8½	..	..	..	..	..	..	..	..	
Middleton Electric Traction Co. ..	March, 1902	8·5	10·53	4 8½	90 G	15	49½	28	3	3	..	500	Glover & Co.
Musselburgh and District ..	Dec., 1904	6·5	8·125	4 8½	90 G	34	45	16	4	3	..	400	B. T-H. Co., Nat. Elec. Cons. Co.
Nelson Corporation	Feb., 1903	2·74	3·86	4 0	106 G	11	41	11	*4	4	..	400	Blackwell & Co. / British T-H. Co. / Brush Co.
New St. Helens & District Trys. Co.	July, 1899	18	20	4 8½	95 G	13	35	36	*4	4	V. Cp. C.	..	Westinghouse / British T-H.
Newcastle Corporation	Dec., 1901	31·25	61	4 8½	101 G	11	35	223	5	5	V. Cp.	..	Westinghouse / British T-H.
Newport (Mon.) Corporation ..	April, 1903	7·5	14·35	4 8½	98 G	10·5	40	44	5	5	V. Cp.	1,750	Westinghouse
Northampton Corporation	July, 1904	5·5	9·16	3 6	90 & 96 G	18	50	26	3	3	V. C. C.	520	Dick, Kerr, & Co. / Brush Co.
North Shields Tramways Co. ..	March, 1901	..	7·75	3 6	90 G	10	36	22					
North Staff. Trys. (*vide* Potteries)													
Norwich Electric Tramways Co. ..	July, 1900	14·5	19·25	3 6	65½ & 90 G	12·6	38	52	4	4	H. T. Cp.	800	Westinghouse / Blackwell & Co.
Nottingham Corporation	Jan., 1901	19·75	37·5	4 8½	107 G	11·5	40	155	3	3	..	..	British T-H. / Dick, Kerr, & Co.
Nottinghamshire & Derbyshire Tramways Co.	Aug., 1913	12·8	16·10	4 8½	G	..	..	24	*	..	..	..	British T-H.
Oldham, Ashton & Hyde Trys. Co.	June, 1899	8·888	11·183	4 8½	97 G	11	28	46	*3	3	V. Cp. C.	..	British T-H.
Oldham Corporation	Dec., 1900	23·42	36·5	4 8½	100 & 102 G	10·5	40	97	*4	4	..	2,220	Dick, Kerr, & Co.
Paisley & District Tramways Co.	June, 1904	15	25	4 7½	90 G	10	34	58	..	..	..	..	British T-H.
Perth Corporation	Oct., 1905	4·846	6·75	3 6	90 G	16	25	12	5	5	Cp.	500	Blackwell & Co.
Peterborough Elec. Traction Co...	Jan., 1903	5·33	6·71	3 6	94 G	31	35	14	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co.
Plymouth Corporation	Sept., 1899	7·75	15	3 6	92 G	9	35	42	3	3	V. Cp.	..	Elec. Cons. Co. / Westinghouse
Plymouth, Stonehouse, and Devonport	Nov., 1901	1·5	3·62	3 6	84 G	11	34	14	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co.
Pontypridd Urban District ..	March, 1905	5·5	8·6	3 6	96 & 100 G	10	27·6	24	4	4	V. C. Cp.	450	B. I. W. & B.T-H. / Blackwell & Co.
Portmadoc & South Snowdon Rly.	Under cons.	13·25	15	1 11½	41	28	200	6	..	..	..	..	
Portsdown & Horndean Tramway	March, 1903	6	7·5	4 7¾	96 G	16	40	16	2	2	Oil	200	Dick, Kerr, & Co. / Brush Co.
Portsmouth Corporation	Sept., 1901	15·75	30·83	4 7¾	96 & 100 G	17	35	100	5	4	V. & H. Cp.	2,075	Macartney & Co. / Dick, Kerr, & Co.
Potteries Electric Traction Co. ..	May, 1899	31·67	41·48	4 0	87, 90, 100, & 110 G	11	45	110	8	8	H. Cp. / V. Cp.	2,275	Dick, Kerr, & Co. / Blackwell & B.T-H.
Preston Corporation	June, 1904	10·54	17·2	4 8½	95 G	16	28	33	2	2	H. Cp.	600	Dick, Kerr, & Co.
Radcliffe Urban District ..	April, 1905	5	6·5	4 8½	100 G	15	40	..	3	2	V. Cp.	..	Mather & Platt
Rawtenstall Corporation	May, 1909	12	15·9	4 0	100 G	15	38	24	*3	3	..	850	Westinghouse
Reading Corporation	July, 1903	7·44	13·175	4 0	96 G	16	35	36	4	4	V. Cp.	400	Blackwell & Co. / Dick, Kerr, & Co. / Westinghouse
Rhondda Tramways Co.	July, 1908	17·5	24·5	3 6	95 G	15	45	50	8	4	..	1,400	British T-H. / Brush
Rochdale Corporation	May, 1902	19·58 (A)	22·74 (A)	4 8½	103½ G	11·7	30	69	..	..	..	..	British T-H. / Dick, Kerr, & Co. / Brush Co.
Rotherham Corporation	Jan., 1903	10	12	4 8½	100 G	9·5	45	36	*6	6	H. S. Cp.	1,485	Dick, Kerr, & Co.
Rothesay	June, 1902	4·81	9·68	3 6	94 G / 77 G	24	34	20	3	3	V. & Oil	350	Dick, Kerr, & Co. / Westinghouse
Ryde Pier, Isle of Wight Ryde Pier Co. (3) ..	March, 1886	·5	1	4 8½	30 & 34 V	..	..	4	2	2	Gas	..	Siemens Bros.
Salford Corporation	Oct., 1901	41·25	75·79	4 8½	103 G	20	47	200	*8	9	V. Cp. C.	2,400	Westinghouse / Mather & Platt
Scarborough Tramways Co. ..	May 1904	5	7·75	3 6	90 G	10·5	35	22	2	2	Stm. Turb.	..	Brush & B.T-H.
Sheerness and District	April, 1903	2·5	2·704	3 6	94 G	43	40	8	6	5	V. Cp. C.	100	Siemens & Halske / Brush Co.
Sheffield Corporation	Sept., 1899	40	77·84	4 8½	110 & 116 G	9·5	35	339	7	7	1 H. Cp. / 6 V. Cp.	5,725	British T-H.

* Current from combined lighting and traction station. (1) G.B. surface contact system. (2) Mainly Conduit system, but there are now several Trolley lines. Besides the electric lines the London County Council has also 4·45 route miles of horse tramways. (3) Third rail system. (A) Not including 17·1 miles track leased.

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ELECTRIC TRAMWAYS (contd.).	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines.	Type of Engines.	Total Capacity Traction, KW.	Principal Contractors for Electrical Equipment.
				ft. in.	lbs.	1 in	ft. rad.						
Shipley Urban District	May, 1902	6	10	4 0	98 G	15	..	..	4	3	..	..	British T-H.
Soothill Nether U.D.C. & Dewsbury & Ossett Corporations ..	Nov., 1908	3·125	4·45	4 8½	90 G	13	50	8	*	..	..	..	Nat. Elec. Cons. Co.
Southampton Corporation	Jan., 1899	10·25	18·5	4 8½	96 G	13	45	70	6	6	H. Cp. C.	1,000	Westinghouse
Southend Corporation	July, 1901	7·01	10·24	3 6	90 G	18	48	31	*6	6	V. Cp. Con.	2,075	British T-H.
Southend Pier (1) Southend Corp.	Aug., 1890	1·25	1·25	3 6	60 G	Lev.	..	25	..	..	..	..	British T-H.
South Metropolitan Elec. Try. Co.	Feb., 1906	13·09	26	4 8½	95 G	16	42	51	*8	6	Stm Tbs	1,650	Dick, Kerr & Co.; Brush Co.
Southport Corporation (5)	July, 1900	13·5	10·75	4 8½	87 & 90 G	25	45	26	*3	3	H. Cp.	600	Dick, Kerr, & Co.
Southport Electric Tramway Co. ..	July, 1901	8·17	12·52	4 8½	87 G	Nil	40	21	*				
Southport Pier	1905	1	1	4 0	..	..	..	3	..	..	..	..	Westinghouse
South Shields Corporation ..	March, 1906	5·7	10·25	4 8½	95 G	15	35	40	2	2	V. Cp. C.	1,100	Dick, Kerr & Co.
South Staffordshire	Jan., 1893	18·98	29·5	3 6	97 & 90 G	17	46	46	3	3	C.H. Cp.	..	Blackwell & Co.; E. C. C.
Stalybridge, Hyde, Mossley, and Dukinfield	May, 1904	23·75	27·75	4 8½	99 G	9	27½	60	9	3 Marine; 2 Stm. tur.		7,900	Dick, Kerr, & Co.
Stockport Corporation	Aug., 1901	16	27·62	4 8½	96 G	10·8	35	50	*5	5	Cp.	1,000	Dick, Kerr, & Co.
Sunderland Corporation	Aug., 1900	10·92	20·35	4 8½	96 G	12	36	70	*4	4	..	936	Dick, Kerr, & Co.
Sunderland District Electric Trys.	June, 1905	14·27	15·97	4 8½	90 G	11	40	33	*	..	..	..	British T-H.
Sutton & Howth (G.N.R., Ireland)	June, 1901	5·3	6	5 3	72 B	16·7	300	11	3	3	V. Cp.	500	British T-H.; Westinghouse
Swansea Tramways Company ..	June, 1900	12·43	18·54	4 8½	84 & 86 G	14	45	65	3	3	H. Cp. C.	620	British T-H.
Swindon Corporation	Sept., 1904	3·7	4·4	3 6	105 G	15	37	12	5	4	..	600	Dick, Kerr & Co.
Taunton Electric Traction Co.	Aug., 1901	1·66	2	3 6	90 G	25	35	6	*	..	..	..	Blackwell & Co.
Torquay Tramways	April, 1907	6·95	11·125	3 6	90 G	12	45	18	*2	1	..	..	British T-H.
Trafford Park Estates, Ltd. (Trys.)	July, 1903	2·5	2·75	4 8½	100 G	Nil	35	7	4	4	Tand Cp.	..	Westinghouse
Tynemouth and District	March, 1901	4·21	7·83	3 6	90 G	10	30	21	*3	3	..	..	Blackwell & B.T-H.
Tyneside Tramways & Tramroads Co.	Sept., 1902	10·97	16·23	4 8½	95 G	10	40	24	*				
Wakefield & District Lgt. Rlys. Co.	Aug., 1904	24·69	40·382	4 8½	96 G	15·5	40	69	5	5	..	1,200	Dick, Kerr, & Co.
Wallasey Corporation	March, 1902	8·75	19·86	4 8½	98 G	14	40	67	*3	3	V. Cp. C.	1,100	Blackwell & Co.
Walsall Corporation	Jan., 1904	13·5	19·5	3 6	90 & 92 G	18·5	32	39	*8	8	V. Cp. C.	1,730	British T-H.; Electric Cons. Co
Walthamstow U.D.C. Light Rly. ..	June, 1905	9·14	12·53	4 8½	100 G	18	40	38	*15	15	Gas	1,560	Westinghouse
Walton-on-Naze Pier	Aug., 1898	·5	·5	3 6	36 V	..	..	3	3	2	..	100	Blackwell & Co.
Warrington Corporation	April, 1902	6·5	9·6	4 8½	90 G	27	50	21	*6	6	V.C.	500	British T-H.
Wemyss and District	Aug., 1906	7·5	9	3 6	95 & 97 G	18	85	17	3	3	2 V. Cp.	..	Bruce Peebles & Co
West Bromwich Corporation ..	Dec., 1902	7	12·5	3 6	98 G	20	49	29	8	8	Turb'nes	750	Dick, Kerr, & Co.; B. I. W. Co.
West Ham Corporation	Feb., 1904	15·5	30·05	4 8½	100 G	18	40	118	*3	3	V.C. Cp.	1,500	Brush & B.T-H.
Weston-super-Mare	May, 1902	2·39	3·5	4 8½	90 G	25	40	12	5	4	Cp.	..	Blackwell & Co.; British T-H.; Brush Co.
Wigan Corporation	Jan., 1901	30·9	45·42	3 6; 4 8½	105 G	12	45	73	*8	8	..	740	Blackwell & Co.
Wolverhampton Corporation (3) ..	April, 1902	13·5	21·5	3 6	91 G	15	37·5	52	*10	10	H. & V.C. & Turb's	2,900	British T-H.; Electric Cons. Co.
Wolverhampton District	April, 1900	14·75	19	3 6	90 G	20	40	30	*4	..	..	..	B.I.W. & B.T-H.
Worcester Electric Traction Co. ..	Feb., 1904	5·86	8·58	3 6	94 G	13	45	15	*3	3	..	..	Westinghouse; Brush Co.
Wrexham and District	April, 1903	4·44	6·16	3 6	96 G	9·11	50	10	*6	..	..	..	Dick, Kerr, & Co.
Yarmouth Corporation	June, 1902	10	14·4	3 6	90 & 95 G	27	48	35	3	3	Comp.	..	British T-H.
York Corporation	Jan., 1910	6	9·9	3 6	100	18	40	31	*8	8	V.C.	..	Brush Co.; B.I.W. Co.
Yorkshire Woollen District ..	Feb., 1903	22·25	36	4 8½	94 & 100 G	8	30	69	*	..	..	..	Dick, Kerr, & Co.; Brush & B.T-H.
RAILWAYS.													Brush Co.; Dick, Kerr, & Co.
LONDON AND VICINITY:													
Central London Rly. Co. (1) ..	July, 1900	6·5	13	4 8½	100 V	30	..	68 M. 172 T.	6	6	H. Cp. C.	..	British T-H
City & South London Rly. Co. (1)	Dec., 1890	7·25	14·75	4 8½	60 V; 80 V	30	120	52 L. 142 T	(a)	..	..	..	Mather & Platt.; Elec. Cons. Co.; British T-H.
East London Railway (2) ..	April, 1913	5·75	11·5	4 8½	90 B	..	..	(c)	..	..	..	..	
Gt. Northern & City Rly. Co. (2)	Feb., 1904	3·5	7·75	4 8½	85 V	52	660	35 M 45 T	6	..	..	..	British T-H.
Great Western Railway .. (Hammersmith and City line.)	Nov., 1906	4·9	10·5	4 8½	97½ B	60	400	40 M. 80 T	10	10	V. Cp.	..	British T-H.; Elec. Con. Co.
London & North Western Rly. (Euston-Watford line in progress) (2)	May, 1914	41·5	80	4 8½	..	..	..	..	..	..	Turbine	..	Siemens Works; Westinghouse
London & South Western Rly. (Extensions in progress) (1)	Under cons.	47	150	4 8½	..	..	168	84	..	..	Turbine	..	Dick, Kerr & Co.; British T-H; Westinghouse
London, Brighton, and South Coast Railway (4) .. .. (Extensions in progress)	Dec., 1909	22	70	4 8½	..	..	..	16 M. 8 T.	*(d)	..	..	..	British T-H.; Blackwell & Co.
London Electric Railway Co.: Baker St. & Waterloo Ry. (2)	March, 1906	7	14·0	4 8½	90 B	60	330	36 M. 72 T.	(a)	..	..	..	Westinghouse; British T-H.
Charing Cross—Hampstead Railway (2)	June, 1907	8	16·5	4 8½	90 B	33	330	60 M. 90 T.	(a)	..	..	..	Westinghouse; British T-H.
Great Northern, Piccadilly & Brompton Rly. (2)	Dec., 1906	9·25	18·5	4 8½	90 B	33	330	72 M. 144 T.	(a)	..	..	..	Westinghouse; British T-H.
Metropolitan Railway (2) ..	Jan., 1905	26	59	4 8½	86 B	44	363	86 M. 172 T	4	4	Turbine	..	Westinghouse; British T-H.
Metropolitan District Railway (and running powers) (2)	July, 1905	41	80·46	4 8½	86 B	40	330	234 M. 286 T.	(a)	..	Turbine	..	British T-H.; Westinghouse
Waterloo and City Rly. (1) ..	Aug., 1898	1·5	3	4 8½	87 B	30	321	17 M. 12 T.	6	6	V. C.	..	Siemens Bros.; Dick, Kerr & Co.
PROVINCES:													
Lancashire and Yorkshire (2) .. (Extensions in progress)	March, 1904	43	85	4 8½	86 B	85	840	38 M. 52 T.	6	5	1 V.C.; 4 H.C.	..	Dick, Kerr, & Co.
Liverpool Overhead Rly. Co. (1)	March, 1893	6·5	13·05	4 8½	60 V	40	429	46 M 7 T	7	7	H.Cp.; V.Cp.	..	Electric Cons. Co.; Dick, Kerr, & Co.
Mersey Railway (1)	April, 1903	4·5	9	4 8½	86 B	27	528	24 M. 37 T.	5	5	V.Cp.	..	Westinghouse Elec. & Mfg. Co
Midland Rly.—Morecambe and Heysham Branch (4)	June, 1908	9·75	19·5	4 8½	..	..	..	8 M. 0 T.	4	4	Gas.	..	Westinghouse; Siemens Bros.
North Eastern Railway (1) ..	March, 1904	35	80	4 8½	90 B	55	792	60 M. 50 T.	(b)	..	..	..	British T-H. Co.

*Power from combined lighting and power station. (1) Third rail system. (2) Third and fourth rails system. (3) Lorain surface contact system. (4) Single phase. (5) Not including 9 miles owned but leased. (a) Power supplied by Chelsea Power Station (80,000 H.P.) (b) Power purchased from the Newcastle-upon-Tyne Electric Supply Company, Limited. (c) Rolling stock supplied by Metropolitan Railway. (d) Power supplied by London Electric Supply Corporation.
M—Motor Cars. T—Trail Cars.

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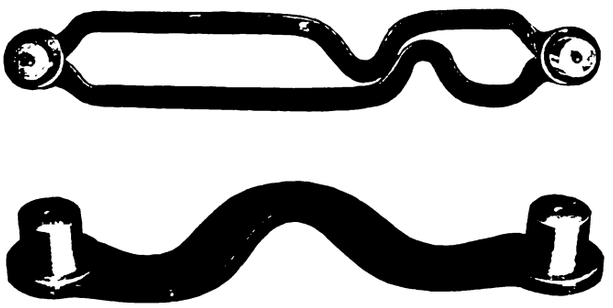
RAIL BONDS



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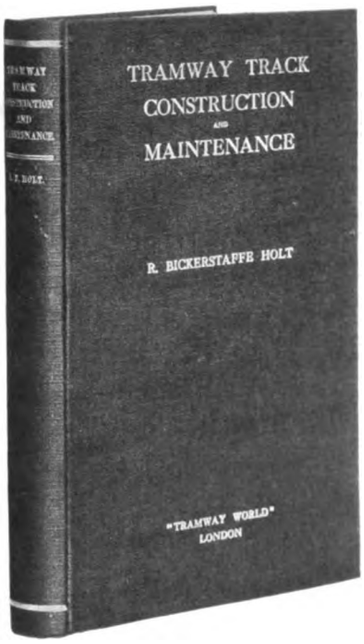

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TRAMWAY TRACK CONSTRUCTION AND MAINTENANCE

BY

R. BICKERSTAFFE HOLT,

HIGHWAYS AND PERMANENT WAY ENGINEER, CITY OF LEEDS:
MEMBER INSTITUTION OF MECHANICAL ENGINEERS;
MEMBER INSTITUTION OF CIVIL ENGINEERS, IRELAND;
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MEMBER MUNICIPAL TRAMWAYS ASSOCIATION;
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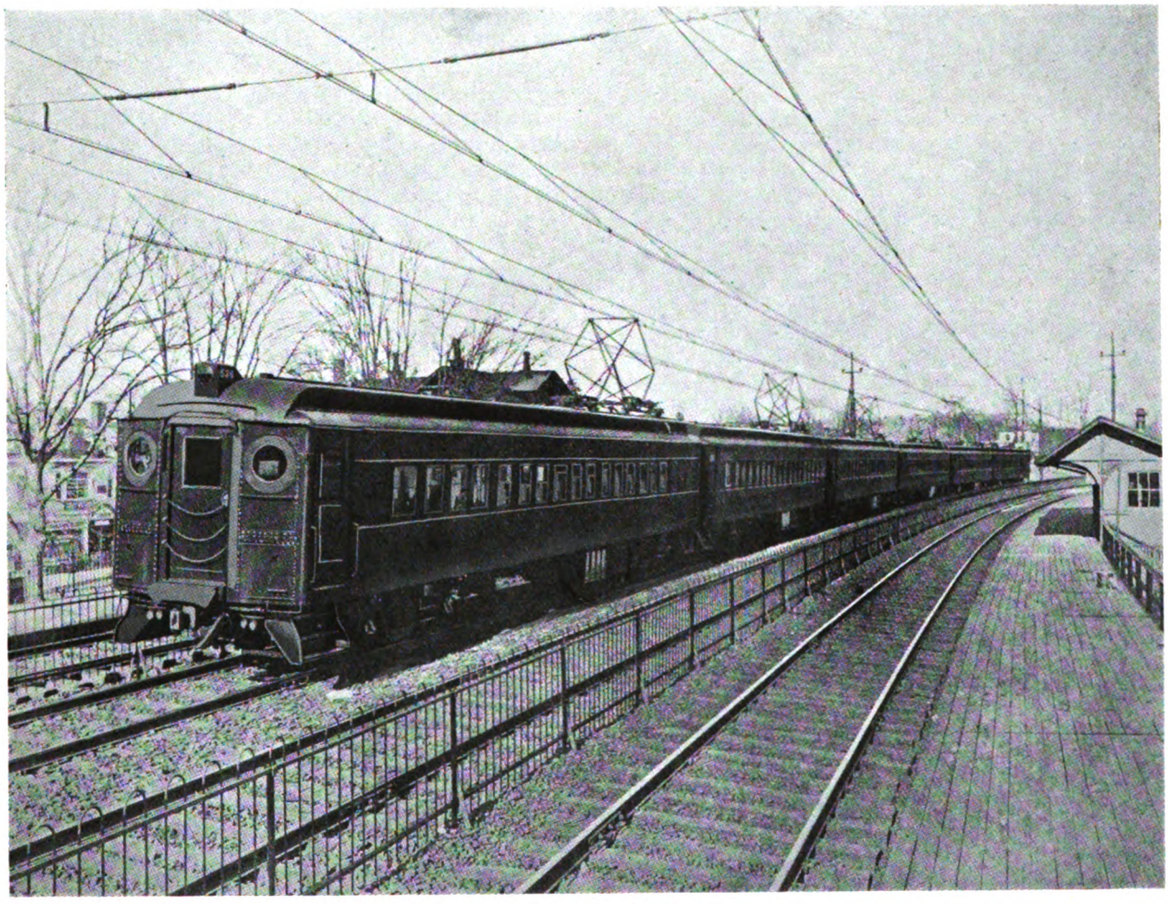
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, FEBRUARY 10, 1916. VOL. XXXIX.

ELECTRIFICATION OF THE PENNSYLVANIA RAILWAY AT PHILADELPHIA.

SINGLE-PHASE HIGH TENSION TRACTION ON SUBURBAN LINES.

The same considerations that led to the electrification of the suburban lines of the London, Brighton and South Coast Railway and the London and South Western Railway have led the Pennsylvania Railroad to electrify twenty miles of lines from the Broad Street Station at Philadelphia. This is a terminal station, having sixteen roads approached by six main lines and three branch tracks on an elevated structure which crosses the Schuylkill river at West Philadelphia, where the routes to New York diverge toward the north, to Washington towards the south, and to Pittsburgh toward the west. Besides the through traffic routes, there are six different suburban services. The full capacity of the station under the conditions of steam operation had been reached, and any plans for its enlargement would have involved expensive and tedious reconstruction. Thorough investigation brought convincing evidence that recourse to electrification would afford the necessary relief in the most economical way. Careful estimates indicated that if the Broad Street-Paoli section alone were equipped for electric traction, it would be equivalent to enlarging the station by nearly 20 per cent. of the service on that route, and on the station as a whole it would have the effect of reducing the total number of trains by 8 per cent. A similar increase in capacity would result from the electrification of other suburban routes. In consequence of these facts the Broad



Train of Multiple Unit All-Steel Cars on the Pennsylvania Railroad.

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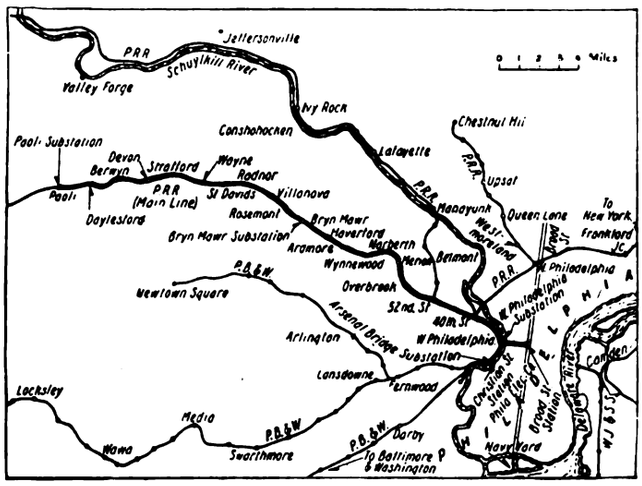
Street-Paoli section has now been electrified, and the equipment of the Chestnut Hill branch, 12 miles in length, has been commenced. It has been estimated that with the new equipment the saving in working costs will pay the interest charges on the additional investment which, in this case, will include the most expensive portion of the work, inasmuch as the Broad Street terminus, with complicated yard and approaches, forms part of the construction required for a relatively small amount of train service. In addition there are the well-known advantages of electrification, including the higher speed of trains, greater punctuality, and pleasanter conditions of travel. The question of a selection of the system best suited to the conditions received very careful consideration; and eventually the high tension, single-phase system was adopted with overhead trolley wires and the elimination of moving machinery in sub-stations. Great importance was attached to the possibility of long-distance operation over the whole division in the future, the immediate requirements for the present suburban service taking a secondary place in the decision. Consequently we have, in this case, 25 cycle, 11,000-volt single-phase power supplied from an overhead trolley system, an arrangement similar to that of the London, Brighton and South Coast installation. Detailed accounts of the work



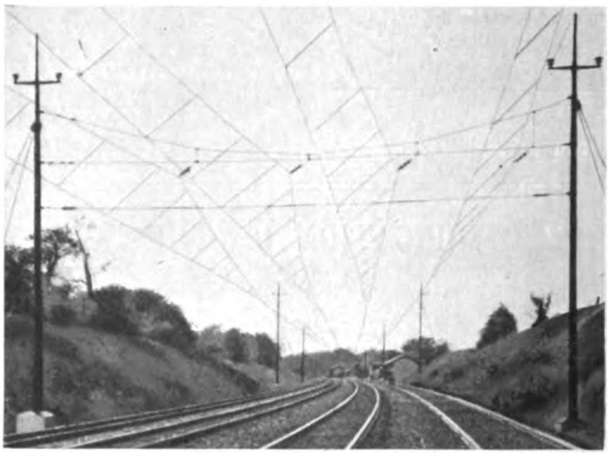
Pennsylvania Electrification near Philadelphia.

Denotes lines electrically equipped.

now completed have been supplied by the engineers and contractors, and have recently been published in America. From these sources the following brief description has been compiled.

The section at present equipped consists of 22 route miles, or a total of about 93 miles of track, including repair yards, etc. The railway company has not constructed its own station, but purchases power from a supply company whose main station is about a mile south of the West Philadelphia station. Thence the energy is delivered at 13,200 volts, through four 350,000 circular mils. three-conductor submarine cables, to the railway company's sub-station. Here it is stepped up to 44,000 volts, and is then transmitted to the step-down sub-stations. Two of the four single-phase transmission lines are continued beyond the West Philadelphia sub-station to Bryn Mawr and Paoli sub-stations. The other two cables at present terminate at West Philadelphia sub-station, but they will later be carried on to Chestnut Hill sub-station. The transmission lines of No. 00 seven-strand hard-drawn copper wires, protected by $\frac{3}{8}$ in. steel grounded wire at the top of the poles, are carried on catenary supporting structures on both sides of the track in the usual way.

The Arsenal sub-station is equipped with three 5,000 K.V.A. step-up transformers, and the West Philadelphia, Bryn Mawr and Paoli sub-stations have each two 2,000 K.V.A. step-down transformers. In all the sub-stations the transformers are of the 25 cycle



Typical Catenary Construction on Curve.

single-phase, oil-insulated, water-cooled type. They are equipped with thermostats which operate an alarm bell in case of high temperature. All the 44,000 volt circuits are connected through the bus-bars in the various sub-stations to oil circuit breakers. Open bus-bars mounted on insulators carried on pipe framework are used throughout. Telephones are provided in all sub-stations, and the signal towers controlling them, so that the power director is in touch with all the sub-stations and power men.

The tubular cross-catenary type of overhead construction is used, the cross wire bridges being placed about 300 ft. apart on the straight and closer on curves. Every mile or two the overhead construction is anchored to heavy structural signal bridges.

The catenary system over each of the four main tracks is separated electrically from those over the other tracks, and trolley sectionalising points with switches are provided at all crossovers, so that sections

A Trio of the Erecting Gang at Work.

of the line may be temporarily cut out of service for repairs. On the main running tracks sectionalising is of the "air-break" type. At crossovers and in yards, the trolley wires are sectionalised by means of wood stick insulators, having runners or gliders on each side so arranged that, while the pantograph always

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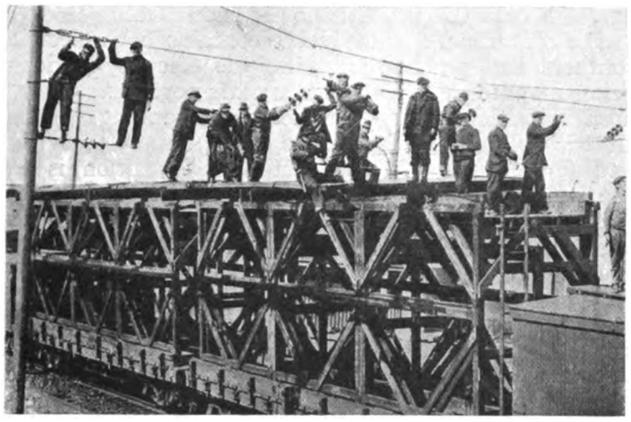
makes contact with at least one of the runners, they are separated electrically.

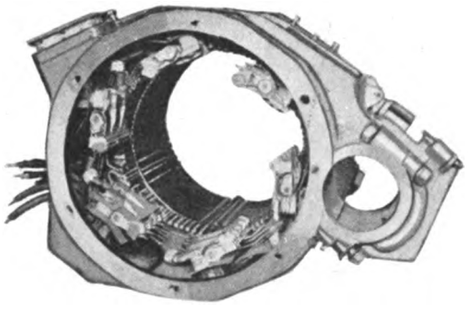
An accompanying illustration shows the manner in which the erection of this catenary work was carried out. Cars were used, the top platforms of which could be raised or lowered readily by means of chain hoists. These cars were also equipped with removable outriggers, so that in the four-track section the work

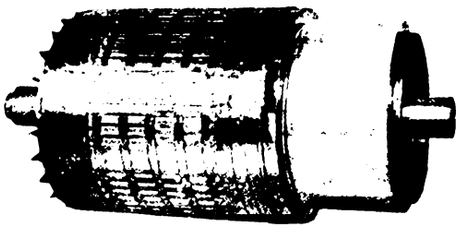


Erection of Catenary Line from Platforms Erected on Railway Wagons.

could be erected completely over one of a pair of tracks without in any way interfering with the regular steam traffic on that track.

In order to minimise the inductive effect of the traction currents on adjacent telephone and telegraph wires, special series transformers are located about a mile apart. These transformers are mounted on the signal bridges, and the current in each of the trolleys is led through a primary coil of the transformer, thus inducing an equal current in the secondary coil, the ratio of the transformers being approximately unity.

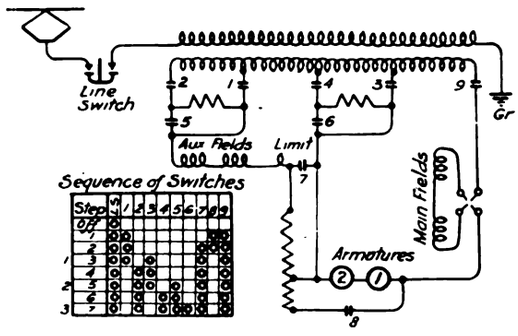




Armature and Rotor of Repulsion Motor.

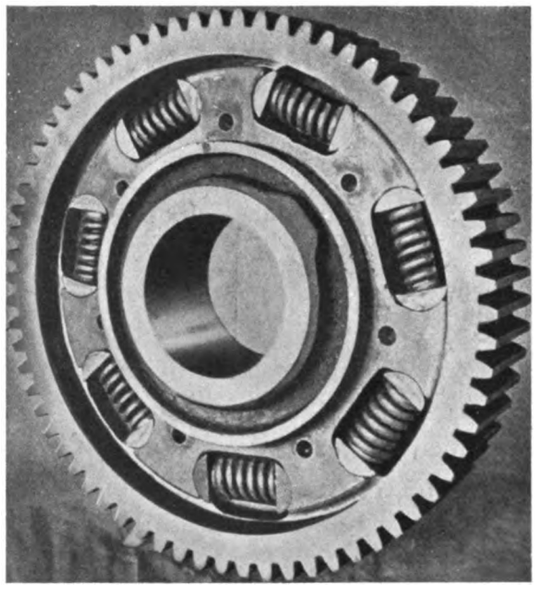
The secondary coils of these transformers are connected across insulated joints in the track, and consequently, as all trolley current must flow through the primary coil, the secondary coil insures that all the returning traction current, at this particular point of the circuit at least, must flow through the rails. In this manner the traction current is prevented from taking earth returns in parallel with the track.

An interesting feature of the electrification is that the standard suburban steel coaches of the type used in the regular steam service have been used for the electric service without structural changes. This was made possible by the fact that the requirements for mounting electric apparatus on the cars had been thoroughly considered at the time when the steel car was introduced on the railroad. There are 93 of these standard all-steel cars in the service, and they are all



Schematic Diagram of Connections of Doubly-Fed Motor.

motor cars, as no trailers will be used. The equipment of each car consists of two 225 H.P. single-phase, air blast-cooled, battery controlled equipments mounted on one truck, with automatic acceleration, and automatic multiple unit electric air brake equipment. All of the main pieces of the electrical apparatus are mounted on one end of the car, while the air brake equipment is mounted at the other end. This gives an uneven weight distribution on the two trucks, with approximately 60 per cent. of the car weight on the driving wheels.



Type of 55-Tooth Flexible Gear with Cover Plate Removed.

Each car is equipped complete with two Westinghouse motors, having a 24-tooth pinion and 55-tooth flexible gear ; and each has an hourly rating of 225 H.P., and a continuous rating of 200 H.P. when ventilated with 1,200 cubic feet of air per minute. The flexible gear is made up of a rim, on which the teeth are cut, a centre, a cover-plate, and spring details. The rim

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is spring mounted on the centre, the periphery of the centre and the cover-plate acting as the bearing surfaces for the rim.

The motors, which are connected in series, are started and operated up to approximately 15 miles per hour as repulsion motors, with the auxiliary or compensating field, the armature, and the main field in series. With these series connections, the armature is short-circuited through resistance. Resistance is also inserted in series with the motors on the first step and is cut out on the second step. The third step changes the connections to energise the auxiliary field from one portion of the transformer and the armature and main field, connected in series, from another portion of the transformer, thus affording doubly fed connections. The armature short-circuit is removed when operating as doubly fed motors. Subsequent steps are obtained by increasing the motor voltages.

The master controller drum is energised from the motor generator set, in parallel with the battery, through a control plug, and moving the master controller handle to the right or to the left energises the proper control circuit for forward or for reverse movement of the train. The closing of the unit switches is governed by a current limit switch. Ten control wires between cars are necessary to operate cars in trains with one of these wires performing the dual function of the third operating wire, and the "trolley unlock" wire.

The pantograph is of especially light construction. The springs which raise it are designed to give flexibility to the framework, so that in operation a slight dragging of the trolley takes place, resulting in its following the wire much closer than with a rigid framework. The trolley is lowered and unlocked by air at 70 lb. pressure. A small hand pump is provided for unlocking the trolley when no air pressure is available. The "safety first" principle has been carried out in the provision of a grounding device of novel design. Steps for mounting to the roof are provided at one corner of the car only, and a lever is placed on the roof at this corner. When one climbs to the top of the car, this lever is thrown up, thus locking the trolley in the down position and grounding the entire framework.

The line switch is air-operated, and is closed by energising a control circuit from the master controller plug. The car transformer is of the 2-circuit air-blast type, and is suspended from the centre sill of the car as close to the motor truck as possible. Ventilating air is taken in at the low-tension end, and is discharged at the high-tension end through especially-constructed hoods which cover the air outlets to prevent the entrance of rain and wheel wash.

Nine electro-pneumatic operated switches of standard construction are mounted in one group. The master controllers are of the single-handle type. Nine controller positions are provided; an emergency or "dead man's" position in the centre, and an "off," first, second, and third running positions, for both forward and reverse movements. The controller drum is spring returned, and, if released, will return to the middle or emergency position. In this position the control is cut off and a valve magnet is energised which releases air from and operates a brake pipe relay, thus applying the emergency brake. Each controller also has two push button switches for unlocking or lowering the trolley. Control energy is obtained from a motor generator operating in parallel with a battery.

The fan for ventilating the transformer and motor is a 21 in. single inlet Sirocco wheel, and is mounted on the shaft of the motor which drives the compressor. The motor drives the fan continuously, and the pinion driving the compressor is connected to the motor by a disc clutch. The motor is of the doubly fed type, and operates at approximately 980 revolutions per minute, at normal voltage, with the continual loads of the fan and compressor, while the speed with the fan alone approaches 1,300 revolutions per minute.

A line or voltage relay is provided for cutting the direct-current control generator from the battery, and also to operate two small emergency lights and headlights in case the traction power should fail.

The motorman's brake valve contains both electric contacts and pneumatic parts, the electric portions being mounted above the pneumatic portions. There are six positions:—(1) The release and running, (2) the electric holding, (3) the handle off, (4) lap, (5) service, and (6) emergency. The first-named position is to the left, and in this position all train brakes are released and the system charged. The "electric holding" position, as the name implies, holds the train brakes through the electric control system but recharges the system. Pneumatically, this position is identical with the release and running position. All ports are closed in the "handle off" position, and the handle may be removed; in the "lap" position, the ports are also closed. The "service" and "emergency" positions are for applying the brakes for service or emergency application. In making a service application, a limiting valve in conjunction with the brake valve allows a maximum reduction of 20 lb. in the brake pipe. A small cut-out plug is provided for cutting out the electric operation when desirable.

The main reservoir pressure carried is 100 lb., and the brake pipe pressure is 70 lb. To permit the operation of these equipments in steam service, where the brake pipe pressure is 110 lb., without making adjustment, a main reservoir bypass and limiting valve is employed. By its use the same cylinder pressure is secured in making an emergency application in either steam or electric service, although the operation of the universal valve is the same for either. In steam operation, the pipe line, which is used as a main reservoir line in electric service, is used as a signal line.

Trains of from two to seven cars are operated in regular service, the average acceleration on a straight level track being approximately one mile per hour per second up to 30 miles per hour, with a balancing speed of 60 miles per hour.

The electric installation was carried out by Messrs. Gibbs and Hill, of New York, the consulting electrical engineers for the Pennsylvania Railroad, in co-operation with the engineering department and the officials of the railway company. Messrs. Gibbs and Hill, it may be recalled, were the consulting engineers for the electrical equipment of the Bluefield-Vivian section of the Norfolk and Western Railway, which was fully described in our issue of July last.

Voltage of Live Rails.—With reference to the voltage on live rails in the working of an electric railway, we understand that while the Board of Trade have made no regulation preventing the introduction of any system employing a higher tension than 1,200 volts, they are advised that it is desirable some experience should be obtained in this country with 1,200 volts before this is exceeded. The statement is of interest in view of the use of 1,200 volts on the direct current system for the Manchester-Bury line of the Lancashire and Yorkshire Railway Company. A complete account of this electrification, together with 50 illustrations, appeared in The Tramway and Railway World of January 13.

Ilford's Electric Tower Wagon.—In the annual report of Ilford Council Tramways, Mr. L. E. Harvey, the manager, states that the Edison tower wagon has given the most satisfactory results. He expresses the opinion that if the hired horses used in connection with the permanent way were replaced by a 2-ton electric wagon the change would be profitable.

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DIRECT-CURRENT TRACTION AT 5,000 VOLTS.

Accounts have recently been published in the American engineering journals of experiments which have been conducted on a line between Jackson and Grass Lake, Michigan, on the system of the Michigan United Traction Company. The main point to be established was the practicability of the use of direct current at a pressure of 5,000 volts for traction motors, and according to the reports the scheme is proving highly successful.

The controversy between the advocates of direct current and alternating current traction has been a long one, but a large section of engineering opinion is in favour of the former system in most circumstances. The great drawback to it has been the comparatively low tension, 500 to 600 volts, which was employed, necessitating on long lines numerous sub-stations for converting the high-tension alternating current used for transmission to the low tension direct current used at the motors. In this country an outstanding feature in the matter has been the gradual development by Dick, Kerr and Company, Limited, of a system both of generation of direct current of high tension and of motors and other equipment for dealing with it on the trains. By this scheme the advantages of direct current are obtained and its disadvantages are eliminated. For a considerable time the experimental work by the firm mentioned on the Bury and Holcombe Brook section of the Lancashire and Yorkshire Railway has been going on successfully. Here direct current at a pressure of no less than 3,500 volts is fed direct to the car motors. Overhead wire conductors are, of course, used. On the Manchester to Bury section of the same railway, which was fully described in our issue of January 13, a third rail conductor with direct current at 1,200 volts is being employed. This is the highest pressure yet used on a third rail conductor in this country, and the rail is specially protected. It hardly seems likely that the Board of Trade will allow very high pressures on third rail conductors, and we must look to the employment of overhead wires for further developments.

Though Dick, Kerr and Company, Limited, have been pioneering so long, progress of a more rapid kind in the way of application has been made in the United States, where there are fewer restrictions on developments and where there is abundant country to open up. It is about five years since 1,200-volt direct current was first tried in America. Then came 1,500 volts, and in 1913 came 2,400 volts on the Butte, Anaconda and Pacific Railway installation. This was followed by the use of direct current at 3,000 volts on a section in Montana of the Chicago, Milwaukee and St. Paul Railway. Such advances indicate how successful the new method is. Now we have the experiment resulting in regular operation of the line in Michigan with direct current at a pressure of 5,000 volts.

The experiment has been carried out for more than six months with a single car, and this in reality presents greater difficulties than if a powerful locomotive drawing a train were employed. The locomotive would afford more space for a large well-insulated motor and for all necessary auxiliaries.

In describing the equipment we shall mainly take as our guide Mr. N. W. Storer, general engineer to the Westinghouse Electric and Manufacturing Company, who recently contributed an article on the subject to the *Electric Journal*, of Pittsburg. The equipment was designed and built by the company mentioned for the purpose of determining the practicable limit to which voltages for direct current railways could be carried. Five thousand volts was selected for the initial limit, as it is high enough to make it easily possible to collect current for the largest locomotive from an overhead wire and high enough to lessen the amount of line copper and the number of sub-stations, and to secure a good load factor and efficiency at reasonable cost. The initial experiments involved the design and construction of two 2,400-volt motors and the necessary control equipment, which were mounted on a car and tested on the works railway at East Pittsburg in the spring of 1914. The equipment was first arranged for series-parallel control with voltages of 2,400 to 3,000 on the trolley; then the two motors were connected permanently in series, and the equipment worked at a trolley voltage of 4,000, which was gradually increased until the equipment was finally tested with 7,000 volts at the trolley.

The results were such that it was determined to place a complete four-motor equipment in service. The Michigan United Traction Company agreed to co-operate with the Westinghouse Company in the test, and offered the use of a branch line from Jackson to Grass and Wolf Lakes for the purpose. This line is about 12 miles long, and the high-voltage section extends to about two miles from the centre of Jackson. The car must therefore work over the 600-volt line within the city limits. The trolley line was re-insulated, and space was provided in a sub-station at Grass Lake for a mercury arc rectifier equipment to furnish the high-tension direct current for the car. A complete car equipment consisting of four 100 H.P. motors with control and auxiliaries was installed on one of the Michigan United cars. The complete car weighs about 40 tons. The entire equipment has been installed beneath the car.

On June 1, 1915, preliminary tests were begun after the regular service had been completed for the day. They continued for a few nights until it was certain that the equipment was in proper condition, and the car was then put in daily service for the last two or three round trips between Jackson and the Lakes, which could be handled by a single car. Since that time the operation has been fairly regular for these trips, and up to date it has continued without a single interruption to the service due to the car equipment. It has not been necessary to change any detail in the equipment since service began, and it has always been ready for operation when line and power were available.

Of course, the most difficult part of the equipment would appear to be the motors. It is well understood that in order to secure the maximum benefits from electrification a railway must be able to operate not only locomotives but multiple-unit car service; consequently, any system of electrification that hopes for recognition for heavy traction purposes must be suitable for operation on passenger cars. It is not so difficult to secure space for the necessary number of commutator bars and the creepage surface for insulating large locomotive motors for high voltages, but it has been a serious problem to secure these requisites for a motor of the size required for ordinary inter-urban cars without exceeding commercial limits for weight, cost, and dimensions. The motor is known as a twin armature bi-polar motor, and has many advantageous features for high voltage work. The bi-polar motor permits the use of double the voltage on a given commutator that is possible with a four-pole motor. The twin armature type weighs little more than a corresponding four-pole motor; fewer field coils are required than are used with the four-pole motor; the two armatures, being geared to the same axle, act as one unit, and cut the pressure on the gear teeth in half. The two armatures are connected in series; conse-

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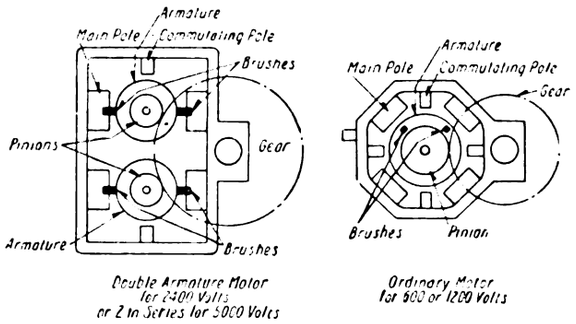
quently, the voltage on each is reduced to lower limits. The form of motor lends itself readily to a very effective type of insulation. The mechanical construction is simple and rugged.

The performance of the motors has thus far been all that one could ask. There has yet to appear the first defect in any motor that has been built. The commutation is sparkless, and the stability of the motor,



Comparison of 5,000-volt Motor and Ordinary Motor.

as shown by its absolute freedom from flashing, is perfect. Large creepage surfaces are supplied, both on armatures and brush-holders, in order to give immunity from grounds. One characteristic that will assist in the maintenance of the insulation is the fact that the current is small—being only 16 amperes for each 100 H.P. motor—that only a few small brushes are required, and with the excellent commutation, there is very little wear either on brushes or commutators, and consequently the amount of carbon and copper dust originating in the motor will be small. It is fully recognised that upon the permanence of the insulation depends the success or failure of the experiment, and this is something that time alone can determine.

In starting, the eight armatures of all motors are connected in series. After the car has accelerated, and the controller is thrown to the running position, the motors are operated in two parallel groups, each group having two motors (four armatures) connected in series. Therefore the maximum voltage impressed across a single armature is 1,250 volts. The series field windings of the motors are all connected near the ground side of the circuit, therefore the field coils are insulated for low voltage operation. The armature coils, however, are insulated for 5,000 volts.

The commutator is but 3 in. wide and has the mica between segments undercut in the usual manner. Standard carbon brushes are employed. Contrary to what might be expected, with a direct current operating voltage of so high a value, the commutator shows no arcing whatsoever. In fact, it is in perfect condition. Each twin motor is equipped with two commutating poles, one at the top and the other at the bottom.

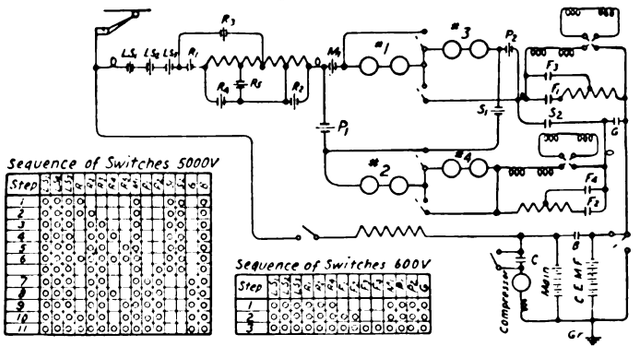
Regarding the control, in order to secure a relatively large number of breaks in series without increasing the number of switches unduly, each switch was made with two breaks in series. The switches are similar to the standard Westinghouse electro-pneumatic switches, but have some special features. The object was to secure safety and reliability in opening the high-voltage circuits, and the most effective distribution of insulation. The frames of the switch group are grounded, and the interlock wiring is thoroughly protected in order to isolate the high-voltage current from the control wiring and master controller. A novel feature is the use of an "arc splitter," consisting of a piece of soapstone placed in front of the switch jaws in the path of the arc. The effect of the magnetic field is to blow the arc against this along its entire length until it is broken. The operation of the switch groups has been fully as satisfactory as that of the motors.

The starting rheostat is composed of cast alloy grids in a number of frames. The latter are insulated from ground by triple insulation and from each other by double or quadruple insulation.

For the purpose of working through the city of Jackson on a 600-volt circuit, a change-over switch is provided, which connects the four sets of armatures in parallel.

The entire auxiliary equipment is worked from a 150-volt circuit. A 150-volt storage battery, to which all of the auxiliaries are connected, is placed in the main motor circuit between the motors and ground. All the main motor current therefore either goes through the battery and charges it, or through the auxiliary circuits which may be connected to the battery at the time the motors are working. By the application of a simple device the air compressor does practically all of its work when the main motors are operating, and thus simply diverts a part or all of the main motor current as required, so that the battery is relieved from furnishing the current to the compressor motor and at the same time does not receive the high charging currents that would otherwise be imposed on it during acceleration. The battery has thus a very light duty to perform, and can be made up of small cells.

In the main schematic wiring diagram given below the double break switches are indicated by three parallel lines across the circuit and the single break switch by two lines. It will be seen that there are twelve of the former and ten of the latter required for this equipment. Considering the fact that these switches control not only the main motor circuits for



Schematic Control Diagram of 5,000-volt D-C. Equipment.

both 5,000 and 600 volt operation, but all of the auxiliaries as well, the equipment is very simple. Very satisfactory operation on 600 volts is secured by shunting the fields of the motors.

Power for operating this car is obtained from three mercury arc rectifiers, which receive power from a 60-cycle, three-phase system, and are operated in series. Connecting the three phases of the system in series gives not only a smooth current wave, but balances the load on the three phases of the transmission system. This is believed to be the first time mercury arc rectifiers have been used in this way to furnish so much power for high voltage work.

It is fully recognised that these tests have not continued long enough to draw any definite conclusions as to the future use of 5,000-volt direct current for railways. All that can be stated at this time is that the preliminary tests are extremely satisfactory, and the fact that no difficulties in the car equipment have appeared to date indicates that there is ground for the hope that the 5,000-volt direct-current railway is a possibility.

It will be noticed from the above description that high-tension direct-current generation is not involved. The working current is derived through the rectifiers from a high-tension three-phase supply.

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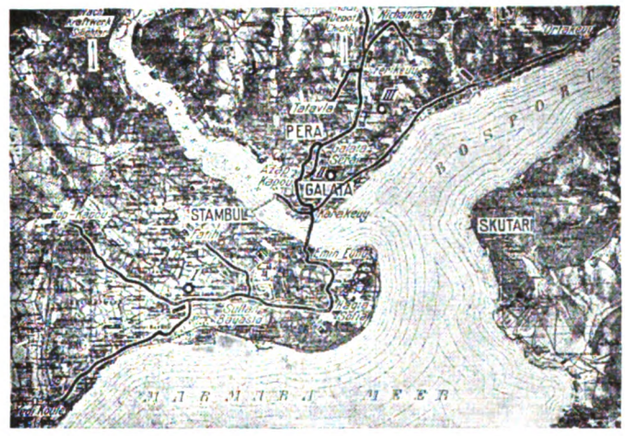
MODERN TRACTION AND A MEDIÆVAL CEREMONY.

That "east is east and west is west, and never the twain shall meet," is strikingly exemplified in the curious scene depicted in the illustration below. It is a photograph of a rite performed on one of those familiar and very modern occasions, the formal opening of an electric tramway. In most civilised countries

The Ceremony at the Linking-up of the Constantinople Tramways.

when the labours of the financiers, the engineers, and the contractors have been happily completed, and the electric car conveys smoothly over welded joints the applauding populace, whatever else may have been bled no innocent and inoffensive ram is called upon to shed its blood as a propitiatory offering. It is true that even in the immaculate United States certain creatures known in Wall Street as "lambs" are sometimes "sheared" in the process of electric railway promotion, but that operation is not commonly heralded by a public ceremony. There is this similarity, however, between the sacrifice of a ram in Constantinople and the shearing of a "lamb" on the opening of an electric tramway—both are intended to serve a useful if illusory purpose. In the latter case the idea is that the promoter deserves a suitable reward for his services in the past, while in the former case the celestial powers require to be propitiated lest they should interfere with the smooth working of the cars in the future. As far as we have been able to ascertain, the electric tramways of Constantinople have not suffered from supernatural interference since their opening several years ago. Their history has, in fact, been uneventful until a few months ago, when a British submarine considerably damaged the famous Galata Bridge over the Golden Horn, across which the tramcars ran. Previous to the war 160 motor cars were in service or on order, besides a number of trailer cars. The equipment of the line presents no special features. Working at the customary pressure of 500-600 volts, the motors were of a type common on the continent of Europe, and the single-deck cars were provided with a bow trolley.



Map of Constantinople Tramways.

The undertaking is not, however, without significance, because it forms an instance of the enterprise by which German firms, assisted by Government influences, and, in this case, by active official participation, have been enabled to secure control of local enterprises in the near East. There was a time when tramway enterprise in Turkey was entirely in British hands; and it is safe to say that if our Government had been as greatly concerned that our interest in these undertakings should be continued under the new conditions of electric traction as the German Government was, that they should be supplanted, the work would not have passed out of our hands. The same supine policy which at length cost us the antagonism of Turkey had for many years been a source of discouragement and defeat to many enterprising business men who, with more energetic co-operation on the part of our official representatives, would no doubt have greatly strengthened our influence.

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THE
Tramway and Railway World

FOUNDED IN 1892 AND PUBLISHED BY
THE TRAMWAY AND RAILWAY WORLD PUBLISHING COMPANY, LIMITED,
AMBERLEY HOUSE, NORFOLK STREET, LONDON, W.C.

SUBSCRIPTION:

THE TRAMWAY AND RAILWAY WORLD can be obtained, post free, at the following rates:

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THE ANNUAL SUBSCRIPTION INCLUDES 64 ISSUES, OF WHICH 12 ARE ILLUSTRATED NUMBERS.

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Single Copies—One Shilling (Postage, 2 pence—Abroad, 5 pence).

THE EDITORIAL AND PUBLISHING OFFICES OF
THE TRAMWAY AND RAILWAY WORLD
ARE AT AMBERLEY HOUSE, NORFOLK STREET,
LONDON, W.C.

Telegraphic Address: "TRAMIGRO, LONDON."
Telephone No.: GERRARD 2948.

LONDON, FEBRUARY 10, 1916.

A Review of the London Traffic Position.

In this issue the full text is published of a highly interesting paper on London traffic by Sir Albert Stanley, managing director of the Metropolitan District Railway Company and associated companies. The paper was presented to the International Engineering Congress, which was held in San Francisco in the latter part of September. Though there has been some unavoidable delay in presenting it to our readers, the paper is well worthy of study. Many of the main facts are known by students of the subject, but Sir Albert's paper has several great merits. One is that it is a comprehensive review of the subject, and another that as it was addressed for the most part to those unfamiliar with the *locale* and conditions of the undertaking, it is, so to speak, an exposition to people knowing little or nothing of the matter, and it thus has much freshness. Too often those who have followed a given subject for a long time are apt to get into the state of not being able to see the wood for the trees. Many general facts tend to sink into the realm of sub-consciousness, and such a paper as the one now referred to is a valuable corrective and a sharpener of the apprehension. In making reference to the various means of public transit in London, Sir Albert dwells on the difficulty of co-ordination, the lack of a general authority, and the need for a Traffic Board, as recommended years ago by a Royal Commission. It is only natural that, speaking with the special information at his disposal, the managing director of the biggest local transit organisation in the metropolis should give much detailed information as to passenger traffic which cannot be obtained from ordinary published reports. For example, the details as to traffic fluctuations according to the season, the day of the week, and the hour of the day, will be noted with interest. His history of the development of the train services on the main line of the District Railway is well worthy of attention. In the days of steam traction the maximum number of trains per hour in each direction was 18. After the adoption of electricity ten years ago efforts were made to get over the difficulty arising from the fact that six branch lines converge on the main route. By system, by the adoption of automatic signalling with short block sections, and by the construction of fly-over junctions, the number of trains was gradually increased till it reached 43 an hour in each direction. Within recent months (as noted in our last issue) it has reached the wonderful figure of 50. Sir Albert has a good deal to say on the subject of fares, and points out as desiderata that they should be even in incidence, sure and settled in composition, and simple in arrangement. That is by no means the case at present. Urban railways, tramways, and motor omnibuses alike come under review, and the last-mentioned are very favourably spoken of. In regard to the present low return on the capital invested in the various undertakings, Sir Albert is quite sanguine that the traffic can be so expanded as materially to improve dividends. The general conclusion is that further development can only be properly secured by a spirit of co-ordination and co-operation among all the interests concerned. The fostering of such a spirit, however, is the difficulty, for it is not easy to bring about co-operation between municipal bodies and private enterprise. Still, there have been some encouraging beginnings in London, and something may be hoped for. And that brings us back to the old necessity which the London County Council and the companies alike desire, but to which the Government object—the constitution of a Traffic Board.

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Rail Corrugation. This question is always with us, and a solution has not yet been found. Remedies suggested, if of any use at all, are very partial. Naturally it is not easy to find a remedy for an evil so long as the cause or causes of the evil are unknown. The two British tramway associations, which a few years ago were hard at work investigating the problem, appear to have slackened their efforts ; at all events little in the way of reports from the investigation committees has recently been published. The subject is again being discussed in the American engineering press, but it cannot be said that any great new light has been thrown on it. One writer thinks that the trouble is caused by load concentration due to reduced area of contact as the result of irregularities, or of a difference between the contours of the rail head and the wheel tread. This theory has the advantage that its accuracy can be tested by providing wheels and rails that conform to one another. The writer in question has tested his theory, with the result that no corrugation appeared in five years. Mr. R. B. Holt, in his work on tramway track, points out that much wear of rails is caused by the wheel tread and the rail head being of different contours. A new tire will not fit a worn rail and *vice-versa*, and the remedy is to design the rail head so as to fit a partially worn tire. This remedy for irregular wear is the same practically as the American's remedy for corrugation, but if it were always effective there should be less corrugation than we see. A fairly worn tire and a fairly worn rail represent ordinary conditions, and they are generally associated with a full bearing across the width of the rail tread. Another American writer revives the old idea that corrugation is caused by rigid track construction. But there are plenty of lines in foreign countries, some of them steam railways, which are laid on sleepers so as to give an elastic track, and yet corrugations appear. Years ago reports from India showed that railway rails were corrugated when one kind of ballast was used, and not corrugated when another kind was employed. It is to be feared that the Americans are no nearer the solution of the problem than we are.

Efficiency Meetings. The inauguration of a series of what are called efficiency meetings of the officers of the various departments of the London Underground Railways and of the London General Omnibus Company is a departure which ought to prove of much value. Staff meetings in connection with various undertakings are familiar enough ; they are held for the discussion of immediate business and the arrangement of things of the moment. But the efficiency meetings here referred to are of a wider scope and directed to more general views for the purpose of improving the efficiency of all the departments concerned. They are like meetings of a highly specialised technical society at which certain subjects only are dealt with, but are considered intensively and exhaustively. Papers are read and discussed, so that the collective knowledge and opinions of the officers are brought to bear on each subject. The essence of the matter is the discussion of methods adopted in the operation of the railways and the omnibuses with a view to improve them still further. The opening meeting, which is reported on another page, dealt with the subject of employees' mess-rooms and their organisation, and among the matters to come before subsequent meetings are a parcel system on the Underground Railways, the graphic representation of operating returns, time tables and duty sheets, and tickets and other checking devices. Mr. H. E. Blain, the operating manager, to whom the initiation of the plan is due, is to be congratulated on an innovation that might usefully be adopted in the case of the larger tramway undertakings of the country. Anything that encourages *esprit de corps* and promotes enterprise and a certain enthusiasm in work that tends too easily to degenerate into prosaic routine is an experiment well worth trying.

Dublin Tramway Results. In the United Kingdom there are now few companies operating tramway systems in large cities. The Dublin United Company is one of the few, and it is interesting now to compare some of its accounts with those of the pre-war period. The company, which was formed nearly twenty years ago to acquire the old Dublin United Company and the Dublin Southern Company, has always

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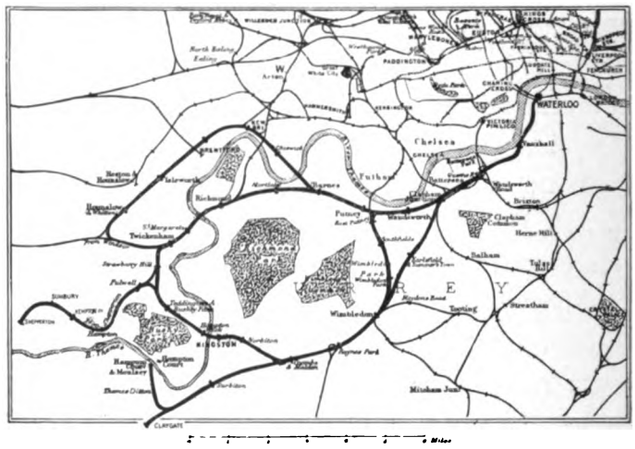
been well managed, and has steadily paid good dividends. The report for the year 1915 just issued shows a total revenue of £333,899. This compares with £297,731 for the year 1913, the last complete year before the war broke out. To some extent the figure for 1913 was affected by strikes, and there was a recovery to £321,896 in 1914. Last year the total expenses were £209,383, as compared with £177,858 in 1913. After meeting fixed charges, etc., the balance available for dividend was £95,845, which is £7,805 better than the corresponding figure of two years before. The usual conservative financial policy of the directors has, however, been even more emphasised than before, as the dividends on the ordinary shares are only 5½ per cent. per annum as compared with 6 per cent. for 1913. Much larger sums are set aside for reserve and renewals, and the carry-forward is substantially greater. These results were obtained by carrying over 60 millions of passengers, or six millions more than in 1913. At both dates the length of route was the same, namely, 54 miles. The economy in operation may be judged by the fact that the purely working expenses average less than 6¼d. per car-mile. The company is thus on a sound basis, and can look forward with confidence to the future. That future is also considerable as to time, as the lines cannot be purchased by the local authorities till the end of 1938. As a set-off to that, the wayleaves payable to the local authorities amount to about £15,000 per annum. Though that is by far the biggest item among the fixed charges, the company continues to bear the burden of it without trouble. The company has for many years had the advantage of being managed by some of the best business men in Ireland, and though during the past year it had the misfortune to lose by death two well-known and respected officers, there is no lack of capable successors to carry on their work.

Melbourne and Sydney Electrifications.—An application has been made to the Victorian Legislature by the Railway Commissioners for a loan of £800,000 towards the electrification of the Melbourne Suburban Railways, excluding the construction and alteration of rolling stock An announcement has been made by the New South Wales Minister for Public Works, that the construction of the City Electric Railway will be begun in March. Work is being pushed on in connection with the electrification of the Sydney North Shore Railway. The Railway Department have been advised to proceed with the construction of new rolling stock, so that it may be ready for use as soon as power is available.

"SOUTH WESTERN" ELECTRIFICATION.

On January 30 electric trains began running on the Kingston loop and the Shepperton branch of the London and South Western Railway. The opening of electric traction on these routes had been delayed owing to Post Office complaints of interference with telegraphs and telephones, but that matter has now been partially adjusted. The length of the South Western Railway Company's suburban lines which are being electrified is 47 route miles. The Kingston loop and the Shepperton branch, together with the main line from Waterloo to Wimbledon, *via* Putney, which has been working electrically for some weeks, account for over half the total length. The remaining suburban lines are expected to begin electric operation shortly. A full and illustrated description of the undertaking appeared in our issue of November 18 last.

The new trains are running to Shepperton with great smoothness and celerity. The stops at stations have been cut down to half a minute each, and this, coupled with rapid acceleration and a higher maximum speed than that of the steam trains, has reduced the schedule time very appreciably. Moreover, instead of the long intervals between the steam trains, there will soon be a ten minutes service of electric trains in each



South Western Electric Lines.

direction on the Kingston loop. This loop service is one of the most important of the suburban services of the company.

The district covered by the electric trains includes a number of popular places, which will gain much by being brought within closer reach of that "full tide of human existence" which, as in Dr. Johnson's day, still flows about Charing Cross. Moreover, much of the route has great potentiality as a residential district, which has only been partially developed under the somewhat antiquated service hitherto provided. It is a fact, we believe, that the train service to Wimbledon, a town of some 60,000 inhabitants, until the end of last month enjoyed practically the same direct service to Waterloo that was provided for it 20 years ago. Such instances as this give some indication of the immense opportunities that our railways have let slip in the indolent *ante bellum* days. It may be thought that in the period after the war our impoverishment will be so great that railway improvement will be out of the question. On the contrary, however, the necessity of economy in operation will be so severely felt that electrification on a scale hitherto unknown will become imperative. Neither time or money can then be wasted in the slow and extravagant steam service of metropolitan suburban lines.

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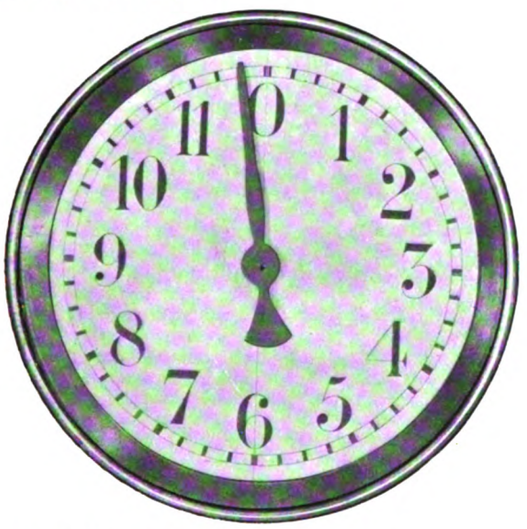
HEADWAY INDICATORS IN TRAMWAY SERVICE.

The great aim of the manager of a tramway system is to maintain a constant service of evenly spaced cars. Not to provide such service is a serious impediment to the growth of traffic. If there are long intervals between the cars crowds of passengers collect at various points, so that when the belated car arrives it has to make an abnormally long wait before it can set down and take up the increased number of passengers with which it has to deal. This fault, instead of being removed, is increased at every stopping point, and results in over-crowding and consequent grumbling with further delay to tramcars following.

The old method of placing a man at certain fixed points to act as a timekeeper is open to many objections, principal among which is the human element of error. There is also the expense of wages to be dealt with.

To overcome this difficulty, the Equipment and Engineering Company have recently acquired the patents of the Dallett electrical headway indicator, which was, until quite recently, manufactured by the late National Electric Time Company, of Clerkenwell. These indicators, one of which is shown in the accompanying illustration, consists of a very simple device, including a solenoid which actuates a train of gear wheels incorporating a self-starting escapement. The whole is mounted in an iron case provided with a dial and single pointer as shown. To actuate the indicator in tramway work, it is erected upon one of the trolley standards by suitable clips or upon a convenient wall site, and a skate contact is fitted upon the adjacent trolley wire.



The action of the device is as follows :—

A car passing under the skate causes current to flow to the indicator and round the coils of the solenoid referred to. This actuates the train of gear wheels by means of a chain and draws up a driving weight, the movement being steadied by means of an air dash-pot. This action also has the effect of bringing the pointer from any reading it may have shown upon the dial back to zero. When the car has passed and the solenoid in the indicator has ceased to be energised, the driving weight comes into action and propels the pointer round the scale under the restricting influence of a small self-starting pendulum escapement. The normal dial is made for a maximum interval of 12 minutes, but, of course, it is possible to make them for any scale up to 30 minutes.

In such a simple mechanism as that described, there is very little to get out of order. The whole of the mechanism is strong and suited to the most severe conditions. To enable access to be obtained to the working parts when necessary, the dial is split vertically down the middle, so that when the front bezel, which fits with a weather-proof joint, is removed, and a small latch unfastened at the top of the dial, the two halves fall sideways and the whole of the indicator is exposed.

These indicators have been in use for some years upon the Metropolitan District and the London Tube Railways, where they have proved their efficient action. They are, indeed, an absolute necessity where automatic signalling is used. There is no means, other than the indicators, to inform the drivers of the headway space in front of them, and without their use there would be continual trouble owing to trains getting out of spacing, and also having to stop in tunnels against a signal, necessitating another starting current. The use in tramway systems is obvious, especially upon routes where the service of cars is scarce. The Equipment and Engineering Company, of 2 and 3, Norfolk Street, London, W.C., are prepared to supply an indicator for trial purposes to any company who are considering the adoption of these devices, and will also be glad to furnish full details to anyone who communicates with them.

THE BRADFORD POWER BRAKE.

Adverting to the new power brake in use on some of the Bradford Corporation tramcars, Mr. J. C. Spencer, the general manager of the tramways department, writes as appended in the 1914-15 report to the Tramways Committee :—

"In my last report I stated that our experience up to that time was very satisfactory, but experience had not been sufficiently lengthy to do more than briefly comment thereon. Now, however, I am enabled to state very definitely that the effect upon accidents of the introduction of this new brake has been very marked.

"As the committee are aware, this brake was designed mainly in the interests of public safety. Its main principles are as follows :—No skill is required on the part of the driver for its application. If anything happens to the mechanism, the result is the application of the brake, and consequent stoppage of the car. In case of need, the conductor can apply the brake against the driver, but he cannot take it off against him. It is possible, without any fear of skidding, to pull up a car fitted with this brake in a remarkably short distance. We have now 75 cars fitted with the brake, most of which have been in use for the full year under review. Some of the brakes have been in use for several years.

"The average cost of drivers' accidents throughout the system on all cars taken over a period of four years, including the period under review, amounts to £3 11s. per car per annum. The average cost of drivers' accidents with cars fitted with power brake is 3s. per car per annum, so that quite apart from the question of preventing serious runaways and disasters, the brake has proved extremely valuable in the ordinary way in keeping down and reducing the seriousness of inevitable street collisions, which take place on every system. As against this, it is necessary to consider what, if any, is the extra cost of maintenance of this brake against the old type of mechanical brake. From careful experiments that have been made, and from the records obtained, it is shown that with intelligent handling the increase in current consumption of cars fitted with this brake is so small as to be practically negligible.

"The cost of repairs and maintenance may reasonably be expected to be in excess of the hand applied brake, but in making full allowance for the more or less experimental nature of parts of the apparatus, which it has been found necessary to re-design and improve, there is no reason to think that the cost of maintenance will be seriously in excess of that of the mechanical brake, which it has replaced, for whilst on the one hand there is an increased wear of cast-iron in brake shoes, as against the old wood and iron shoes, there is a very considerable saving in the wear of tires on the other hand. It has been found as a matter of fact that the increased life of steel tires in consequence of this brake is in the neighbourhood of 85 per cent.

"From the drivers' point of view, the impressions, so far as I am able to ascertain them, are unanimously in favour of this apparatus. Unfortunately the outbreak of war has prevented the continued fitting of cars, the manufacturers being entirely occupied on war material. An examination of the return of accidents will show that with the exception of the number of collisions with other vehicles, every other class of accident has increased. This, it seems to me, is inevitable when it is remembered that about 25 per cent. of the staff has been replaced by new and inexperienced labour, and it is remarkable that the effect has not been more serious."

IMPROVEMENTS AT TERMINALS.

NEWCASTLE AND PORTSMOUTH PROJECTS.

The great increase in the number of motor vehicles to be seen on roads where suburban tramways terminate in dead ends is likely to force many tramway authorities to consider the advisability of adopting means to secure the safety of their passengers on entering and leaving the cars. In our issue dated November 18, we gave a description and illustrations of the method devised to secure that result in the case of the Chorlton terminus of the Manchester Corporation Tramways. At that place a looped siding, connected at each end to the main track, has been constructed, together with a shelter for passengers and offices for the employees.

Portsmouth Tramways Committee are about to present to the Corporation a plan for preventing the congestion and danger that occurs at the Cosham terminus during the summer and on holidays. Messrs. W. R. Spaven (general manager) and V. G. Lironi (electrical and permanent way engineer) have prepared a scheme for converting the dead end into a circular line. The main stopping place will be at the west corner of a plot of ground that is proposed to be purchased The cars would continue round the half circle to the opposite side, where covered queues are to be constructed. These gangways will lead to a series of lines from which cars will start on the return journey. Provision is made for illuminating the queues and the destination signs at night.

On account of the narrowness of the roadway where the Scotswood terminus is situated, Newcastle-on-Tyne Tramways Committee have obtained a piece of land in order to construct a loop line. Cars from Newcastle will be able to run along it to the set of rails for the return journey without reversing the trolley pole. The loop can also be utilised for cars waiting to take their return citywards.

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EFFICIENCY MEETINGS.

London Traffic Companies' New Departure.

A commendable innovation has been instituted in the form of a series of efficiency meetings, arranged for the officials of the operating department of the Underground Railways and London General Omnibus group, by Mr. H. E. Blain, the operating manager. The first meeting was held at Electric Railway House, Westminster Broadway, when a paper on "Mess Rooms and Their Organisation" was read by Mr. S. G. Rodway, mess room superintendent of the London General Omnibus Company.

The chair was occupied by Mr. Blain, amongst others present being Sir Albert H. Stanley, managing director; Mr. James Devonshire, managing director of the London and Suburban Traction Company; Mr. Z. E. Knapp, railway manager for maintenance and construction; Mr. W. F. Rainforth, assistant chief engineer, L.G.O.C.; Mr. J. P. Thomas, general superintendent, L.G.O.C.; Mr. H. Lansdown, assistant general superintendent, L.G.O.C.; Captain A. Rozier, A.S.C., superintendent of training and employment, L.G.O.C.; Mr. W. J. Blake, railway superintendent of the line; Mr. S. J. Webb, railway passenger agent, and more than thirty other officials.

L.G.O. Standard Mess Room Equipment.

The Chairman remarked that the series was being arranged for the purpose of enabling both the outside and inside officials to discuss, from an efficiency standpoint, the methods adopted in the operation of the railways and omnibuses, with a view to improve them still further. For this purpose the frankest expression of opinion was invited.

Sir Albert Stanley paid a tribute to the manner in which the work of the department had been carried on during the exceedingly trying conditions since the outbreak of war, and referred to the desire of the companies and the directors that every member of the staff should feel his suggestions would be valued and appreciated, there being the greatest possible desire for close connection between the employees and the companies.

Mr. Devonshire also made some appropriate remarks.

Mr. Rodway's paper detailed the mess room organisation connected with the London General Omnibus Company, Limited. In all the later built garages it was now the policy to erect large and comfortable rooms available as mess rooms and institutes, where the catering was provided at the lowest possible price, and where facilities for billiards, etc., were also afforded. The first of these institutes was opened at Hendon Garage on May 1, 1913, since which date sixteen others had been opened, these being at Cricklewood, Willesden, Seven Kings, Streatham, Merton, Milman's Street, Hammersmith, Turnham Green, Chelverton Road, Golders Green, Forest Gate, Holloway, Hounslow, Plumstead, and Catford. Catering facilities were furnished at Victoria Station. The gross number of purchases made at these mess rooms per annum was about two millions, the average amount of each transaction being 2·44d.

The food, etc., was sold at a cost which practically covered the wages of the mess room working staff, but the account was not debited with any portion of the cost of construction, maintenance, or lighting of the institutes. Attention was directed to the increased cost of foodstuffs, and a chart was exhibited showing the increased prices and fluctuations of the principal dry goods used. The war had forced upon the mess room organisation a higher state of efficiency, but by the careful selection and introduction of modern devices for saving labour and material, such as automatic potato peelers, patent boilers, floor scrubbers, etc., and by making all the pastry at home instead of purchasing from outside sources, it had not been necessary to raise the tariff, except very slightly in connection with tea.

In the subsequent discussion, the different methods of the railway mess rooms were alluded to, the first mess room in which the company carried out the catering having been opened on the Piccadilly line in May, 1912.

For the inspection and criticism of the audience, samples of the omnibus standard mess room equipment had been arranged as an exhibit, and the discussion was of a practical character, embodying the views of purchasers as well as the organisers.

At subsequent meetings the following topics will be discussed:—A parcels system on the Underground railways; the graphic representation of operating returns; time tables and duty sheets, comments and criticisms on methods and practice; railway and omnibus tickets, and other checking devices; a "safety first" campaign—a sound proposition with an unsound title; social welfare and co-operative developments; advertising, publicity, and decorative developments, etc.

TRACK MAINTENANCE.

Cost Under Managers, Electrical Engineers, and Surveyors.

Aberdeen Corporation, at their January meeting, discussed the Tramways Committee's recommendation that a remit be made to them to report as to the existing arrangements in connection with the maintenance and repair of the track and permanent way, and as to what alterations or modifications, if any, the committee would recommend should be made.

In moving a direct negative, Councillor Leith, chairman of the Streets and Roads Committee, said that Aberdeen was in the first rank amongst municipal tramways for maintenance. The average cost throughout the United Kingdom was, under managers, 0·62d. per car-mile; under electrical engineers, 0·55d. per mile; and under burgh surveyors, 0·50d. per mile. In Aberdeen the cost under the surveyor was 0·33d. per mile, or less than two-thirds of the average cost all over the country. The annual cost of permanent way per mile of single track, under the same head, was £168 for the United Kingdom, and £97 for Aberdeen. In two-thirds of the corporations the surveyors had charge of the permanent way. He urged that the new surveyor should be given an opportunity. Councillor George, in seconding, stated that Mr. Gordon, the new surveyor, had agreed to submit to the Tramways Department at the beginning of every month the work he proposed to do, and the system should be given a trial.

Billiard Room at a London Garage.

Councillor Robertson (chairman of the Tramways Committee), in moving the recommendation mentioned that large sums had been saved by the committee investigating reports on proposed repairs.

Although the chairman of the Tramways Committee withdrew his resolution in favour of an amendment to remit the question to both the Tramways and Roads Committees, the Council decided to make no change in the existing arrangements.

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ELECTRIC RAILWAYS.

The James Forrest Lecture, 1915.

The twenty-third James Forrest lecture was delivered before the Institution of Civil Engineers on December 14. The subject was "Electrical Railways," and the lecturer was Mr. H. M. Hobart, in whose absence in America the lecture was read by Mr. John A. F. Aspinall. The President, Mr. Alex. Ross, mentioned that Mr. Forrest, in whose honour the lectures were founded, had now entered on his ninety-first year. Mr. Forrest's association with the Institution had extended over a period of nearly 73 years, and the members sincerely hoped that Mr. Forrest might live to read many more lectures delivered in his honour.

Mr. Hobart's lecture was of such great length that here it is only possible to indicate its contents and to summarise some of its main features. The first part of the discourse was retrospective. In this regard, as in others, the lecture dealt for the most part with heavy freight train traction in America. The following extract, with tables, indicates developments in America:—

Although trains hauled by electric locomotives were in regular operation in 1890 on the City and South London Railway, the first application of electricity to train haulage in America was in May, 1895, when electric locomotives were employed by the Baltimore and Ohio Railroad to haul trains through its Belt Line Tunnels in Baltimore. The rate at which the electrification of sections of American steam railways has grown since that date may be seen from the following table:—

Year.	A.—Electrically-Equipped Single-Track Mileage of Steam Railways in the United States and Canada.	B.—Total Single-Track Mileage of Steam Railways in the United States and Canada.	100 A / B
	Miles.	Miles.	
1895	8	233,000	...
1900	51	259,000	...
1905	215	307,000	...
1910	1,580	352,000	0·45
1915*	3,460	380,000	0·91

* The figures for 1915 include mileage now being electrified.

The above figures, however, do not indicate the growth of the electric railway industry in America. The greatest activity has heretofore related chiefly to independent electric railway undertakings not necessarily involving the operation of trains. The rapid growth of this business is indicated by the statistics in the following table:—

Year.	Total Single-Track Mileage of Electric Railways in the United States and Canada.	Total Number of Motor Cars.
	Miles.	
1890	1,260	5,600
1895	12,100	26,000
1900	19,300	43,600
1905	32,500	64,000
1910	40,000	89,600
1915	45,000	100,000

Cost of Electricity Production.

Dealing with the rapid decrease in the cost of electricity, the lecturer said that it would have been impossible twenty years ago to manufacture electricity at a cost of much less than 2d. per kilowatt-hour. Ten years ago a price of 1d. per kilowatt-hour would usually have been the minimum permitting of any profit. At present there are electricity supply undertakings which could make a profit in supplying electricity to railways in their district at but little over ½d. per kilowatt-hour.

Fifteen years ago the best available electricity generating sets consisted of slow-speed reciprocating engines direct-connected to electric generators. A 3,000-kilowatt set was considered to be about as large as could be used to advantage. Such an engine and generator cost some £30,000 (or £10 per kilowatt). At present 30,000-kilowatt steam turbine-driven sets are available at a price considerably below £60,000—that is to say, the set with ten times the output costs less than twice as much.

Furthermore, while the 3,000-kilowatt generating set of fifteen years ago consumed some 18 lb. of steam per kilowatt-hour, the present day 30,000-kilowatt set only consumes some 12 lb. of steam per kilowatt-hour, i.e., two-thirds as much. The corresponding progress in steam-raising plant and condensing plant has also been by no means inconsiderable, and in conjunction with the requirement of only two-thirds as much steam and fuel, may be roughly taken as at least halving the initial outlay per rated kilowatt installed, for these components of an electricity manufacturing plant.

Discussing the relative merits of hydro-electric and steam stations, Mr. Hobart said that in districts where coal is obtainable at a low price it is rarely possible for a hydro-electric plant to supply electricity at a competitive price except for applications with a fairly high load factor. The price for electricity manufactured in a coal-burning station is much less controlled by the maximum demand and much more controlled by the quantity of electricity consumed in a given time than in the case of a hydro-electric undertaking. While the fixed charges are much lower than the operating costs for the steam undertaking, the reverse is the case for the hydro-electric undertaking. For very low load factors, the steam undertaking can supply electricity at the lowest cost, but for load factors above 0·20 the hydro-electric undertaking has the advantage, and for unity load factor the hydro-electric can supply at practically half the price attainable with the steam undertaking. Since an extensive electric railway will have a fairly good load factor, this is one reason for the remarkable progress made with railway electrification in countries which are rich in water power.

The author proceeded to work out figures to show the influence of fuel cost on the total cost of producing electricity in steam-electric stations. He explained how load factor is improved by increasing the number of electric locomotives supplied, and he noted that the ratio of the combined load factor of the locomotives in use to the average of their individual load factors is called the diversity factor. This led to the following conclusion. One of the most important attributes of the electric-locomotive system of propelling trains relates to the ability to take scientific advantage of the diversity factor of a system comprising many locomotives in providing a high resultant load-factor and to secure economies incident thereto. In fact, the resultant load-factor of the railway's load will combine with the resultant load-factor of the loads of other consumers to yield an ultimate resultant load-factor at the generating station which will usually be appreciably better than the railway's own load-factor. Consequently, a railway rarely manufactures its own electricity for its own exclusively railway load at so low a cost as that at which it can be manufactured by an electricity-supply company whose system comprises the loads of other large consumers.

Butte, Anaconda, and Pacific Railway.

The author proceeded to describe and to discuss results obtained on certain steam railways in the United States which have been changed to electric traction. Descriptions of the electric equipment of these lines have already appeared in our pages. In regard to the Butte, Anaconda and Pacific Railway, the conclusion reached by Mr. Hobart was that the outlay for fuel and power when steam locomotives were used was 19·9d. per locomotive mile, while with electric traction it is only 7d. per locomotive mile. The price of locomotive coal was 19s. per British ton, and the cost of electricity delivered at the sub-stations is 0·265d. per kilowatt-hour. In describing the electric locomotives used, Mr. Hobart pointed out that the average weight of the copper ore trains hauled by the steam locomotives was 1,600 tons, while the average weight hauled by the electric locomotives is 2,100 tons. An elaborate working-out of the results of tests on the heavy gradients of the railway followed. The efficiencies arrived at are given in the following table:—

	Efficiency of Electrica Equipments.	"Drivers-to-Drawbar" Efficiency.	"Pantograph-Drawbar" Efficiency of Locomotives.
	Per Cent.	Per Cent.	Per Cent.
Westbound trip of 3,700-ton train of loaded ore cars from Rocker to East Anaconda at a schedule speed of 20 miles per hour	84·0	97·0	81·5
Eastbound trip of 1,190-ton train of empty ore cars from East Anaconda to Rocker at a speed of 20 miles per hour ...	83·3	95·0	79·2
7-mile trip up Smelter Hill with two 72-ton locomotives hauling 1,316 tons of loaded ore cars, the total train weight being 1,460 tons	83·0	92·8	77·0

The increase in the weight of the trains has, for a given quantity of ore, permitted a decrease in the number of trains per day by 25 per cent. The running time has been decreased, and the hours worked by engine crews, as compared with the steam days, have been lowered by 29 per cent. Though the rate of wages remains the same, the expenditure for wages for engine crews per locomotive mile has fallen from 6·6d. to 3·2d. Owing to the greater speed, less delays, and consequent great reduction in overtime, there has been a saving in trainmen's wages of 21 per cent. The total locomotive expenditure (including maintenance) per electric locomotive mile is 15·1d., compared with 37·5d. per steam locomotive mile. From a variety of figures the author reached the conclusion that the savings, as compared with steam locomotive operation, will within seven years of the inauguration of electric

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operation, i.e., by the year 1920, have liquidated the capital expenditure of £300,000 incurred in the years 1913, 1914, and 1915 for the electrification of 114 miles of single track.

In describing the sub-station machinery, Mr. Hobart mentioned that only two sub-stations are required for the railway, as it is worked by direct current at a pressure of 2,400 volts. If 600-volt current were used, at least six sub-stations would be necessary. The distance between the two sub-stations is 26 miles.

Chicago, Milwaukee, and St. Paul Railway.

The lecture went on to describe the electrification of the 440-mile section (comprising 650 miles of single track) of the Chicago, Milwaukee, and St. Paul Railway, from Harlowton, in Montana, to Avery, in Idaho. The equipment is now being installed, 113 miles being completed. The railway company pay to the hydro-electric power company 0·26d. per kilowatt-hour for the electricity required. There are 14 sub-stations in all, from 18 to 43 miles apart. The working pressure for the railway is 3,000 volts, direct current. The locomotives have a continuous rating of 3,020 H.P., and weigh 250 tons each. One locomotive is 40 per cent. more powerful than two 72-ton Butte locomotives. The heaviest duty is drawing a load of 2,230 tons over a distance of 49 miles with a ruling gradient of 1 per cent. at a speed if 16½ miles per hour The cost for power for this work is put at 43d. per train-mile. With a steam locomotive the speed would be only half the above, and the cost for coal (at 12s. per ton) would be 58d. per train-mile. It will, for the purposes of a rough survey, be assumed that the average consumption of electricity and coal per locomotive-mile will, taken over the year, be only one-third of the amounts estimated for the 49 mile run.

While large Mallet locomotives can be bought for a matter of £24 per British ton, electric locomotives of the type under discussion cost fully three times as much, say at least £80 per ton. On the other hand, the repairs of a 330-ton Mallet amount to at least 12d. per mile, as against not over 5·5d. per mile for the 250-ton electric locomotive. If we credit both locomotives with a 15-year life, crediting the electric locomotive with 35,000 miles per annum and the steam locomotive with 25,000 miles per annum, and debiting both locomotives with 7d. per mile for wages of crew, the account stands :—

	Annual Outlay in Pounds Sterling.	
	Per 250-Ton Electric Locomotive.	Per 330-Ton Mallet Locomotive.
	£	£
I. Fuel and power	2,080	2,020
II. Wages of locomotive crews	1,020	730
III. Repairs of locomotive	810	1,250
IV. Interest (5 per cent.), taxes and insurance (3 per cent.), and amortisation (4·6 per cent.)...	2,400	950
Total of I+II+III+IV	£6,310	£4,950
Do. per locomotive-mile	43·3d.	47·5d.

From the above study, which is based on equal weights of train hauled, the saving in favour of the electric locomotive is of inconsiderable amount. In practice, however, advantage is taken of the inherent ability of hauling heavier trains with electric locomotives and at higher speeds. Indeed, the Mallets actually employed on the Chicago, Milwaukee and St. Paul Railway are much smaller than that on which the above illustration is based, and cannot, even at their lower speed, handle the service for which the electric locomotives are adequate.

In discussing the saving of electrical energy by regenerative control as used on this railway with its heavy gradients, the author pointed out that a further and a main consideration was the less wear of the wheels, brake shoes, and brake rigging. The speed down hill can also be greater. With modern methods of intensive ventilation of motors, regenerative-control equipments can be built with but moderate increase in weight, and still operate within approved temperature limits, notwithstanding the performance of the double function of motoring and generating. For a dense traffic regenerative control presents still further advantages.

Norfolk and Western Railway.

The lecturer next dealt with the electrification of 29 miles of the Norfolk and Western Railway from Vivian to Bluefield, West Virginia (which was described and illustrated in our issue of July 8 last). Electric operation began in May with twelve 240-ton locomotives of the split-phase type ; the working current is at a pressure of 11,000 volts with a periodicity of 25 cycles per second. The gradients are up to 2 per cent., and the traffic is chiefly coal. Trains weighing 2,900 tons each are transported by two locomotives, one pulling at the front and the other pushing at the rear. The speed is 14 miles per hour. Formerly it required three 240-ton Mallet engines, two pulling and one pushing, to make the trip at 7 miles per hour. Another important benefit has been the elimination of congestion at a tunnel where the line is only single-track.

Increasing Train Weights.

An important feature in the adoption of electric traction for heavy freight service was next discussed. Reference was made at some length to the efforts which railway companies in America have been making to increase the ratio of ton-mileage to train-mileage. This has been done by increasing the length and weight of trains and by seeing that they are filled before starting. It appears that during the last 14 years the ratio of ton-miles to train-miles for freight traffic per annum has increased on the average over all United States railways by no less than 68 per cent. Put otherwise, there was an increase of only 22 per cent. in the annual train mileage of freight traffic during the 14 years, but there was an increase of 104 per cent. in the annual ton-mileage. Great economies, especially for long hauls, must have resulted. Thus we have the inevitability of the rapid introduction of the electric locomotive in the further pursuance of this policy. While the steam locomotive has increased in twelve years by 50 per cent., in the feature of the average tractive effort of which it is capable, there has been no notable increase in the speed of freight locomotives. The electric freight locomotive provides any tractive effort permitted by the draft rigging, and also provides any increase in speed permitted by curves, and strength of freight cars and permanent way. The heaviest freight trains may, with electric locomotives, be propelled over heavy grades at twice the speed possible with steam locomotives.

New York Central Locomotives.

The author proceeded to give a description of the " 1913 " type of passenger train electric locomotive in use on the New York Central Railway. It uses 600-volt direct-current, weighs 115 tons, has a continuous rating of 2,000 H.P., and has a tractive effort of 13,840 lb. at 54½ miles per hour. Each locomotive hauls, at 60 miles per hour, a train weighing 1,100 tons. Owing to the absence of gearing, the efficiency of the electric equipment is exceptionally high, the motor efficiency, for a speed of 48 miles per hour, being 91 per cent.

Single-Phase v. Direct Current.

The following highly interesting table was next submitted. It gives data of the growth in the United States of single-phase and high-pressure direct-current electric railways during the last nine years.

Total Mileage of Single-Track Operating and Under Construction.

Year.	Single-Phase.	High-Pressure Direct Current.		
		1,200 and 1,500 Volts.	2,400 and 3,000 Volts.	Total for High-pressure Direct Current.
	Miles.	Miles.	Miles.	Miles.
1906	650	...	...	...
1907	1,040	...	...	...
1908	1,130	...	...	...
1909	960*	...	...	...
1910	990*	600	...	600
1911	1,040*	1,100	...	1,100
1912	1,040*	1,600	100	1,700
1913	940*	2,200	200	2,400
1914	1,340	2,750	450	3,200
1915	1,490	2,810	910	3,720

* The falling off in increase in single-phase mileage during 1909 to 1913 was partly due to changing over eight roads (aggregating over 300 miles of single track) from single-phase to direct current.

The author is satisfied that the high-pressure direct-current system is so distinctly superior in essential respects as ultimately to ensure its general use on main line railways, in preference to the single-phase system or any of its modifications.

Owing to the lower " drivers-to-drawbar " efficiency and the lower efficiency of the electrical equipment of single-phase locomotives, a given output from the drawbar will (taking into consideration all the varieties of traffic on a railway) require so much greater consumption of electricity by the locomotives as to fully offset any economies in sub-stations and distribution system. This conclusion concerning the relative consumption of the two types simply refers to one of the items entering into a comprehensive comparison. Amongst other matters requiring consideration are the relative initial costs of locomotives of equal capabilities of the two types, the relative outlays for repairs, and the relative reliability.

Mr. Hobart proceeded to quote arguments for and against each system, and to maintain the superiority of the direct-current method. He also entered into an elaborate comparison of costs of electricity delivered at the locomotive by the various methods, to show that there was very little difference. This left the single-phase systems handicapped by the greater inherent cost of single-phase locomotives.

The conclusions of the paper are to the effect that :—1st, we are on the eve of the extensive employment of electric locomotives on railroads at present operated with steam locomotives ; 2nd, that the direct-current system is the most appropriate ; and 3rd, that direct-current locomotives for use from high-pressure contact conductors are now a thoroughly demonstrated success.

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LONDON TRAFFIC IN 1913.*

By Sir Albert Stanley
(Managing Director of the Allied Transit Companies of London).

INTRODUCTORY.

London is the largest aggregation of population in the world which looks to a common centre of civic life. It is only possible for such an aggregation to occur where there are adequate traffic facilities. The traffic facilities link up and bind together the widespread areas over which the population is scattered to make its homes. Not only must these be adequate, but they must afford a public service efficient in point of time occupied for the journey and economical in point of charge for the fare. These are the two factors that control the growth.

To secure a healthful standard of life a population should occupy large tracts of land, so that the buildings may be interspersed with pleasant spaces of country. To ensure an active and progressive life a population must be brought closely together for the exchange and sharpening of thought and the sharing of a common weal. The realisation of both these essential conditions depends upon the traffic system. It therefore should rank very high among public services.

I. THE SIZE OF LONDON.

The Central Area.—At the heart of London are the ancient cities of London proper and of Westminster. The area they occupy is only small, being a square mile for the one and some four square miles for the other, and in this extent are included the Royal Parks, about a square mile in themselves. Except for these parks, these areas are almost wholly built over. Yet their permanent population is only small. In the City of London it amounts to 19,657 persons, or 29 to the acre ; and in Westminster, chiefly congregated in blocks of residential flats, to 160,261 persons, or, together, 179,918, giving a density of 56 persons to the acre. Their day population, however, far exceeds their night population. For the City of London this has been ascertained by a special census, and was found to amount to 364,061 persons, or an influx of 344,404. For the City of Westminster no corresponding figure is available, but as the proportion must be somewhat similar, for the business section at least, the influx must, in this case, approach a million folks daily.

The Administrative County.—Around this core lies the administrative county of London, consisting of 27 metropolitan boroughs, with an added area of 112 square miles. Certain districts in the south-east corner of this area are only ill-developed, otherwise the whole of it is fully built over or dedicated to the public use. The population numbers 4,341,767, giving a density of just over 60 persons per acre on the average. Upon analysis this average is found to be made up from densities varying from 170 to the acre in Southwark, Shoreditch, and Bethnal Green, to 37 to the acre in Hampstead, due to the liberal provision of open space, 25 to the acre in Greenwich, 23 in Lewisham, and 15 in Woolwich, these being the south-eastern districts to which reference has just been made.

Greater London.—Then around the County of London lies a further ring comprising nine municipal boroughs, once small independent towns, and 62 urban districts, slowly growing round them and building them in, with parts, too, of some 14 rural districts. These, added to London County, constitute what is known as Greater London. The area of this ring is 576 square miles, and the population 2,729,673, giving a density of about 7½ persons per acre, varying downwards from a density of 62 in the borough of West Ham to densities of less than 1 person per acre in the rural districts. Summing up the figures to this point, Greater London comprises 693 square miles of country and a total population of 7,251,358 persons, with an average density of 16½ persons to the acre.

The Outer Suburban Ring.—Out and beyond this again is a population clustering round the stations of the railways running out from London in long lines, yet looking towards London for its work and interests, grouped together and known as the outer suburban ring. This has an area of 2,115 square miles and a population of 1,219,788 persons, or less than 1 to the acre. It is therefore merely sparsely populated from the point of view of the average, but the inhabitants are drawn up in little local centres, such as the townships of St. Albans with 18 to the acre, of Gravesend with 22, Rickmansworth with 11. Adding the figures for this part on to Greater London, the grand total of the persons centred on London, or affected by its existence, amounts to 8,471,146.

II. TRAFFIC FACILITIES IN LONDON.

It is not easy to give a picture of the traffic facilities of London that will enable a stranger to realise the extent or effectiveness of them.

Railway Stations.—As to the railways, the most useful index is the number of their stations. In the central area, the cities of London and Westminster, there are 38 separate underground stations upon the local urban railways. In the administrative county of London there are 147 separate stations, not counting twice the stations which serve two or more underground lines, and upon the whole local urban system of railways there are 180 stations in all, showing that 33 lie outside the county. This system of railways consists of eight independent lines grouped together under two controls, one with six and a route mileage of 61½ miles, and one with two and a route mileage of 28 miles.

The main line or trunk railways serving London are nine in number with 16 terminal stations. These railways have 159 stations within the administrative county, 251 stations more within the boundaries of Greater London and still 164 more in the outer suburban ring, or altogether 574 stations. The most noticeable feature of the main line stations is the fact that all the terminals are detached and, with the exception of Charing Cross, not located at a really immediate traffic centre. This feature is of some consequence in the consideration of the problems arising out of the operation of London traffic. Each main line railway is in the hands of a separate Company (leaving over some short connecting lines held by other separate companies but under the joint control of the main line railways interested in their traffic). There are no agreements between these companies affecting the passenger traffic of London, so that each is free to pursue its own policy in this respect.

Tramway Routes.—The tramway, or street railway, system is practically excluded from the central area, for reasons of convenience based on the unsuitability of the narrow thoroughfares of the City and on the congested character of the street traffic in the important thoroughfares of the west end. In this central area there are only 2½ miles of tramway route.

The tramway authority for London County is the County Council. This authority owns and operates 145 miles of tramway, roughly divided into two systems, one north of the Thames and one, the larger of the two, south of the Thames. These systems are connected by a single route across the central area, built in subway, and only capable of being operated by single deck cars.

Outside the London County there are various authorities, and they may be divided into two classes :—First, 10 local authorities owning and operating between them 78 miles of tramways, and three private companies, acting as licensees for the local authorities, owning and operating 123 miles of tramways. All these tramways are in Greater London, and there are no tramways in the outer suburban ring that enter London. The interurban express tramway is not known. The best index to the traffic carried by all these tramways is the number of passenger cars which they own. It is 2,780. The size of a tramcar varies from 36 seats to 78 seats, but the most usual size will average 74 seats.

Motor Omnibuses.—Lastly there is the motor-omnibus industry. This has spread a network of routes all over the area covered by Greater London and to parts beyond in the outer suburban ring. It reaches points distant from Charing Cross, the accepted centre, such as Reigate on the south, 22½ miles ; Maidenhead on the west, 31½ miles; St. Albans on the north, 22 miles ; and Romford on the east, 14½ miles, with regular daily services. The maximum extension which it has reached up to date comprises 551 miles of roadway worked by 127 routes, or services, on weekdays, and 609 miles of roadway worked by 122 routes on Sundays. The operation of the system is practically under one control, although the ownership is divided among eight companies. The number of motor-omnibuses outside this control is negligible, being 18 in number, owned by three separate companies. The number controlled was, in July last, 3,525 total stock, with 3,477 working on Whit-Monday, 1914, the day of maximum movement. A motor-bus seats 34 passengers, 16 inside and 18 on the top.

With the outbreak of war the fleet of onnibuses has been broken in upon to perform services of a strange kind, as supply wagons, ambulances, gun-platforms, ammunition wagons, as well as the carriage of troops, so that the present situation is far from normal.

III. THE CONTROL AND REGULATION OF LONDON TRAFFIC.

Not only is the ownership of the traffic facilities in diverse hands, but the control, as well as the regulation of them, is similarly diverse. It is necessary to consider the three types separately.

The Construction of Railways.—First, as to railways, these are built almost universally under a private Act of Parliament, for only by this means can the privileges and powers enjoyed by a railway company be obtained. The procedure through which a private bill has to pass before becoming an Act enables all parties affected or interested to appear and oppose it before the committees constituted of members of each House of Parliament in turn, Lords and Commons, The grounds of opposition are very wide. Competition, the disturbance of property or other private rights, the seeking of conditions, limitations, or restrictions as to the methods of working or conducting the business—always assumed to be in the public interest—and the policy pursued by public bodies under their enabling statutes as related to the project, are all good grounds. In the result a very considerable expense attaches to the inception of a railway. In the

*A paper presented at a meeting of the International Engineering Congress, held a San Francisco, September 20-25, 1915, and briefly summarised in The Tramway and Railway World of November 18, 1915. As there promised, we now reprint the paper in full.

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result again many bargains are made in respect of the proposed railway which were not within the original intentions of the promoters, and many schemes are put forward not because they are necessarily the best, but because they are most likely to successfully run the gauntlet of opposition.

The chief defect of the main line railway system of London is due to a policy which withheld all the main line railways from entering the central area. The chief defect of the underground system of local railways is the piecemeal manner in which they have been designed by small and separate companies, and the lack of any powers of review left to the Legislature, for the Legislature may only accept, or reject, any particular Bill presented to it. Amendments cannot go to the substance of the proposal. Following upon this dispersion of interests, there have been jealousies which are illustrated by distinct and adjoining stations at many traffic centres, representing double costs, and involving only half as convenient interchange arrangements. And, as a last defect, the stations are often upon sites which are second best only, whereas the effectiveness of an underground and invisible system of railways is almost wholly dependent on evidence of it at the critical traffic point.

The possibility of an underground system of deep-level tube railways for London is due to the existence of a thick bed of clay, impervious to moisture, stretching underneath it. The turning to full account of this possibility for railway construction is due to a provision of the Legislature which fixed the compensation payable to the owners of the surface for the right to run tubes underneath, provided that the depth exceeded 40 feet below the surface. Under public streets or property the price is fixed at a shilling per foot run. Under private property the price is fixed at a sovereign per foot run. By other provisions of this period protection is given against claims for damage and vibration arising out of the construction and working of the railway. It is under such special favourable provisions as these that London has been able to acquire the unique system of railways which now serves it.

The Construction of Tramways.—Tramways are built under Acts of Parliament in the same manner as railways. An alternative procedure, by way of provisional order, is available, where the initial inquiry is by officials of a Government department (the Board of Trade), and is, on this account, of less costly character. A provisional order is subsequently confirmed by Act of Parliament as a matter of form. With a view to simplifying the procedure for the obtainment of traffic facilities, the Light Railways and Tramways Act of 1896 was passed, which set up a body of commissioners for the purpose of inquiring into and adjudicating upon schemes submitted to them. The order of the commissioners becomes effective as soon as it is confirmed by the Board of Trade, and, not requiring the sanction of Parliament, curtails both the risk and the expense. Although the procedure to secure a grant of tramways is thus made less expensive and much easier, there are quite different difficulties in the way of a complete and homogeneous system. While in the County of London the County Council is the sole authority entitled to construct and work tramways, and every private or other undertaker is excluded, the cities and municipal boroughs comprised within its limits have each a power of veto upon the construction of a tramway within their respective districts. Thus one can agree and one disagree, with the result of detachment of lines and the re-casting and truncation of schemes to avoid prohibited areas. The door is also opened for negotiations on many questions, such as the type of construction, the services to be provided, the fares to be charged, the upkeep of the street occupied, and, particularly common and burdensome, street widenings and improvements. Not that this veto has not proved beneficial in keeping open large and important streets in the west of London of peculiarly heavy traffic, in checking a prodigal development of tramways of a little useful kind, and in preventing the occupation of unsuitable streets, which frequently occur in old-built places. Outside the London County, both county councils, municipal boroughs, and urban and rural districts are capable of becoming tramway authorities. Only where they waive their prior claim may the private undertaker come in, and in this case purchase clauses, enabling the local authority to take over the tramways, are always included.

Another special type of opposition is that of the frontagers on a route. These are afforded an opportunity of exercising a veto under certain conditions and always of opposing individually.

As a consequence of vesting the power to build and work tramways in the numerous local authorities, tramways are under the control of many hands, just as railways, and not until quite recently, when the financial position of tramways was becoming precarious, have the local authorities concerted together to link up their systems and provide through services of cars and continuous schemes of fares.

Both railways and tramways are subject to provisions designed to secure the safety of the public and to limit the burden of charge which the public may be asked to bear.

The Licensing of Motor-Omnibuses.—The motor-omnibus uses the ordinary streets of the cities and towns just as it finds them. It can ask for no privileged position, but must take its luck with any other competing form of traffic without protection. Therefore there is no need or obligation on it to seek powers or rights from the Government, local or central. None the less the central Government has seen fit to establish certain preliminary conditions with which a motor-omnibus must comply before it is allowed to work on the streets, and has given a discretion to the local authorities as to whether motor-omnibuses shall be allowed to run within their district or not. These measures are rendered effective by requiring a motor-omnibus to take out an annual license. In London the complete effect of these measures is diminished by the fact that in the metropolitan police area, which corresponds closely with Greater London, the licensing authority for the whole is the Chief Commissioner of Police, and he is not vested with a discretionary power like the local authority, but must license the motor-omnibus as soon as the requisite conditions are duly met. These conditions govern the size, capacity, and dimensions of the vehicle, the speed, the equipment, and appearance of the body, and the efficiency of the engine. They are designed to secure that not less than a certain minimum of comfort is afforded whilst a maximum of safety is assured, and to prevent nuisance arising from noise, smell, or dirt. Incidentally, the granting of licenses is a source of revenue, for sums amounting to £5 18s. per annum are payable in respect of each motor-omnibus licensed.

Outside the police area the discretionary power to grant licenses is being interpreted by the local authorities as a power to negotiate terms, though as yet only tentatively. There is increasing prospect of difficulties arising out of this, and already certain districts have refused licenses altogether, to the prejudice of their neighbours. To work the present scheme of routes in London, licenses have had to be taken up in 16 districts.

Inspection and Supervision.—When a railway or a tramway is completed and opened for traffic, the Board of Trade has a continuing oversight over certain aspects of its operations and business, chiefly with a view to seeing that the terms under which it came into existence are observed, but also with a view to establishing a high standard of safety, a uniform treatment of the public, and a fair dealing with the staff employed. In the same way, the Commissioner of Police has a supervision over those aspects of the motor-omnibus industry which are governed by the conditions laid down for licensing, coupled, in his case, with the very effective power of suspending the license, and so removing the motor-omnibus from work, where he has reasons to be dissatisfied. But all this is rather incidental to the working of the traffic of London than essential to the consideration of its problems. There is no power vested in anyone to keep the whole traffic situation under review, or to treat of its real needs and conflicts.

IV. SOME CONSEQUENCES OF THE UNCO-ORDINATED CHARACTER OF TRAFFIC FACILITIES.

The consequences which flow from the detachment and division of ownership, indicated in the preceding section, and the lack of co-ordination and control among the public authorities, group themselves into three problems :—

(1) The isolation and lack of correlation between the urban and trunk railway systems.
(2) The conflict between tramways and motor-omnibuses.
(3) The exposed position of motor-omnibuses, and the conditions attaching to a franchise.

In the Relations of Urban and Trunk Railway Systems.—The distribution of the main line termini on the borders of the central area has already been adverted to in this article The volume of traffic to and from these stations from and to stations within 30 miles of Charing Cross, the assumed centre point of London, is estimated at 365 millions of passengers in the year. Practically all these people have to rely upon other means of transit, such as urban railways, tramways, or motor-omnibuses, for the completion of their journey. As the inward and outward flow of this traffic is confined largely within a limited time, the problem of congestion grows acute, for the auxiliary modes of transit, with the exception of certain motor-omnibuses, do not start at the main line termini with their services, but pass them on journeys from and to other districts of London where they have already obtained a load. In addition, the accommodation at the termini themselves for local services tends to press upon the accommodation for trunk services, and extensive and extravagant schemes of enlargement ensue. For in addition to the high price of land in suitable sites, the enlargement of a station entails a widening of the approach roads over a considerable distance, which must either be in tunnel or on an elevated structure to avoid grade crossings in the streets.

An alternative method of dealing with this problem is the coupling up of the urban or underground railways, at some point beyond their zone of heavy traffic, with the main line railways, and the working of through services of trains within the limits of the flow of the suburban traffic of London. Towards this solution, various steps have been taken. For example, the Metropolitan Railway owns, jointly with the Great Central Railway, 22¼ miles of line running out from Harrow, and terminating at a distance from London of about 40 miles. The District Railway owns extension lines to points such as Uxbridge, 20½ miles ; Harrow, 14 miles ; and Hounslow, 13¾ miles out of London, to which points it projects some of its principal services of trains. Then the District Railway runs over certain isolated sections of the London and South Western Railway to Richmond, 10 miles, and Wimbledon, 9 miles, and is jointly interested with the Midland Railway (Tilbury section) in the running of trains to Barking, 9¾ miles out of London, and to Southend, 38 miles away. Most of these arrangements are of long standing, and arose at a time

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when the distinction between urban and trunk railways was not drawn, and in any case antedate the appearance of the tube railways. But the first real step in the direction of a modern solution on these lines was the agreement between the London Electric Railway and the London and North Western Railway, by which some two extra miles of tube railway were built for the purpose of linking the Baker Street and Waterloo line up to the suburban tracks of the North Western Railway running out to Watford, a distance of 19 miles. This arrangement is coincident with the adoption of electric traction by this main line railway for its suburban traffic. The advantages of such an arrangement are many. The trunk railway comes into possession of a distribution system for its traffic, clear of a large central terminal; the urban railway acquires feeder connections into the territory outside London, waiting to be developed; the public gain almost invariably in more convenient journeys and reduced rates of fare. Now that the initial step has been taken, other railway companies are seriously considering it, and there is reason for strong hopes that the whole network of railways of all kinds serving London will soon be knit together into a coherent and easily used pattern. The disadvantages of such an arrangement should not be wholly overlooked. They arise from the restricted size of the rolling stock used in the underground tunnels. The standard diameter of the running tunnel is 11 ft. 8 in. The cars seat 48 passengers. The diameter of the wheels is 30 in., so that the car floor is lower than that of standard main line coaches by 24 in., and is out of relation to the heights of the main line station platforms. Only in the case of one urban line was this factor brought into active consideration. This was in the case of the Great Northern and City Railway, a short length of line of 3½ miles, where the running tunnel was constructed to a diameter of 16 ft.

In the Conflict of Tramways and Motor-Omnibuses.—The second great problem is concerned with the conflict of tramways and motor-omnibuses. This conflict has taken on a political character, which makes it more severe. The tramways either belong now, or will eventually belong, to the local authorities. Not any of the local authorities of London are empowered to work motor-omnibuses, and the whole motor-omnibus industry is in the hands of privately-owned companies. Both use the same streets, and compete to some extent for the same traffic. The motor-omnibus has since 1912 proved to be a formidable competitor, and the financial condition of the tramways has become insecure. The traffic situation is illustrated in the following table:—

L.C.C. Tramways.

Year.	No. of Passengers.	Per cent.	Average Receipts.	Proportionate share of whole.
			d.	
1911	516,092,489	—	1·04	60·2
1912	501,102,149	2·9 (dec.)	1·03	50·4
1913	522,952,600	1·3 (inc.) on 1911	1·01	41·8

L.G.O. and Associated Motor-Omnibuses.

Year.	No. of Passengers.	Per cent.	Average Receipts.	Proportionate share of whole.
			d.	
1911	340,669,411	—	1·32	38·8
1912	492,858,934	44·7 (inc.)	1·32	49·6
1913	705,156,724	107·0 (inc.) on 1911	1·33	58·2

For the first half of the year 1914 the motor-omnibuses carried 387,926,979 passengers, again a substantial increase on the preceding year. A tramcar being confined to rails, and involving much capital expenditure for construction, is obliged to follow the main arteries of traffic. The motor-omnibus, on the other hand, is free of every street which is capable of traffic. It can therefore develop in the areas adjoining the main roads. It can afford to pioneer in areas that could not afford a tramcar. It is adapted to the affording of cross and interchange connections. Not running on fixed rails, the omnibus adjusts itself easily to the conditions of traffic prevailing in a street. It does not create the blockade which congestion always conduces in a tramway. It falls in with the moving stream on either side of the road, and does not monopolise the centre. This is an important merit in the central thoroughfares of a city.

On the other hand, not running on rails, but using the ordinary surface of the road, the omnibus is subject to limitation as to weight. The total laden weight of a motor-omnibus must not exceed 6 tons. This weight limits the number of passengers that can be carried to 34. An omnibus is therefore a small traffic unit, less adapted to the carriage of heavy peak loads than to the carriage of the constant pick-up traffic of the streets. But experience shows that a quick succession of small units proves to be very efficient, and, added to the wide dispersal over many routes which is possible to omnibuses, this form of transit is capable of undertaking a vast deal of work, and of tackling a really heavy traffic density. To show the relative effectiveness of the two types of vehicle, the average load of a tramcar with 74 seats is 10½ passengers, and of an omnibus with 34 seats is 8 passengers. The relative efficiency of the omnibus, measured in percentage of seats occupied to seats offered is therefore almost twice as great as that of the tramcar.

[Note.—The distance the passenger is carried is not brought into this calculation, but as it must be almost equal for the two types of vehicle, the inference drawn from the figures is a correct one.]

The scheme of motor-omnibus routes worked in London does not contain a single instance where the route merely parallels a tramway route. In every instance the omnibus gives a greater extension or a new connection to that given by the tramways with which it comes into contact. The tramway is laid out on a territorial basis, and the omnibus, escaping from the artificial lines which form the boundaries of districts, is able to consider a route more purely from a traffic point of view.

The tramway, occupying a portion of roadway almost exclusively, is burdened with responsibilities in the way of repair and maintenance of the road surface so occupied. Again, a tramway is treated as an owner of property, and is rateable on its profits, as on an assumed rental, towards local and public purposes. From both these burdens the omnibus is exempt. All it has to pay for its user of the streets are the license fees. Latterly there has been an outcry that the omnibuses were damaging the road surfaces, and this has been made the basis of attempts, partially successful outside London, to specifically tax the omnibuses for the user of the roads. The central Government has had to take account of this outcry, and is proposing to set up a special committee to inquire into all the aspects of the question.

Experience so far has shown that on roads with foundations made sufficiently strong to carry the weight of an omnibus, and with a rigid surface such as that given by wood blocks or the hardest asphaltic macadam, the wear occasioned by the omnibus is less than the wear occasioned by other types of vehicle, and eminently less than that occasioned by horsed traffic. As a general principle it might be laid down that, having regard to its importance to the life and health of a district, it were undesirable to put a tax on traffic facilities at all, but that rather everything should be done to secure them on as cheap a basis to the public as it is possible.

The Exposed Position of the Motor-Omnibus Industry.—The third problem is not a pressing one at the moment, but it has arisen in an acute form in the past, and that is the existence of two or more powerful companies competing with each other for the motor-omnibus traffic. In the year 1908 there were three companies working omnibuses, both motor and horse, in London, whose relative size is shown in the following table. Only the motor-omnibus column counts as really effective, and in this class of vehicle all three were more or less equal.

	Horsed Omnibuses.	Motor Omnibuses.	Total.
London General Omnibus Company...	991	233	1224
London Road Car Company	222	195	417
Vanguard Company	—	242	242

In this year, 1908, the competition was so intense that all the companies were working at a loss. Services were duplicated, racing took place in the streets, and accidents were frequent. Just as the state of affairs was becoming a public question, an agreement for amalgamation was reached, and the London General Omnibus Company absorbed the other two. In 1911 the Great Eastern Company, which had been constituted in 1906, was also absorbed.

There is no existing means by which anyone wishing to work an omnibus within the metropolitan police area, or, in effect, Greater London, can be stopped from doing so, providing the vehicle he proposes to work with complies with the conditions and tests laid down by the police. Therefore the amalgamation in the year 1908 did not close the door to a repetition of the evil situation.

The policy of a small owner differs fundamentally from that of a large proprietor. The small owner's costs are relatively larger, and he demands therefore a higher rate of earning to meet them. To obtain this he requires to work his 'buses on a short central section of route where there is a preponderance of traffic and a greater profit. When several small owners adopt the same policy, the result is not good from a public point of view. On the other hand, the large proprietor is bound, in his own interests, to cover as wide an area as possible, to seek new openings, and to establish himself securely in the task of meeting the public requirements. The London General Omnibus Company has always had routes since 1912, when the present management entered into control, which were unremunerative.

From time to time small fleets of motor-omnibuses were placed on the streets, chiefly by manufacturers through operating companies formed under their control. In this way some thousand motor vehicles had accumulated about this year, 1912, owned and controlled by seven separate companies. With all the seven small companies the London General Omnibus Company has entered into agreements by which it, in effect, pools earnings with them, and takes up the oversight of their traffic working. Only 18 motor-omnibuses, owned by three companies of quite recent origin, are now outside this control at this date. The problem is therefore quiescent. Rumours of

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new companies are frequent, and the fact that they seldom realise is due to the growing strength of the associated companies in possession. The only real remedy would be the granting of a franchise to the existing companies, and then the problem resolves itself into one of terms.

A franchise means a monopoly, and where there is a monopoly it is reasonable to look for guarantees of the interests of the public. It would be reasonable to expect a limitation of the amounts to be charged for fares, and in London, on the analogy of railways and tramways, special cheap facilities for workmen's traffic, a requirement of an adequate service, a progressive improvement in the vehicles and equipment, and, lastly, some co-operation with the railways and tramways already occupying privileged positions.

Some of these matters are capable of expression at once in the clauses of an agreement, but others, and the equally essential ones, are matters of judgment and experience. The crux of the problem is—Who is to be the final arbiter in matters of this sort? Is the company who may own the franchise, or is the local authority who is the representative of the public?

The local authority is vested with the care of the public interests, and is entitled to see that the public transit service is adequately maintained to the most modern standard of requirements at fares as low as may be remunerative. In the execution of these duties the local authority may take a share in the provision of transit facilities, but on this account it must clearly put itself out of court as arbiter. It must on all counts occupy the position of prosecutor.

The real problem, then, behind all the other problems, which arises from the multiplicity of interests and ownerships, the division of responsibility for the control and regulation, the lack of any system of review, is the establishment of an independent Traffic Board. This was the recommendation of the Royal Commission on London Traffic in 1907. Under this recommendation it was to consist of a few expert members, and was to be armed with judicial powers of a wide and effective order. So far only a statistical and recording section of the Board of Trade has been set up. The other alternative is more difficult. If the local authority were to divest itself of its power to interfere actively in the traffic of London, it might be given a judicial power in this matter, subject only to some guarantees to the companies incurring the financial responsibilities for the task if the decisions of the local authorities proved to be inimical to the interests of those whose money was invested in the undertakings. Apart from the difficulty of undoing what is now done, there is a special difficulty in the number of local authorities concerned, and whose co-operation for success would be requisite.

Some solution of this problem is urgently needed; meanwhile the effort made by the Underground Electric Railways Company of London, Limited, to work out a solution independently is worthy of note. This company first acquired an interest in the District Railway in 1903. Subsequently it took over from the promoters the rights to build the three deep level tube railways known as the London Electric Railway. This system was working complete in 1908. At this time it had also acquired control of a large tramway undertaking, the London United Tramways Company, Limited. In January, 1912, it took over the London General Omnibus Company, Limited, and has since then entered into agreements with practically all the other motor-omnibus companies working within the London area. In January, 1913, it extended its control over two other older deep-level tubes, the Central London and the City and South London Railways, and, as a last step, added to its interests two other large tramway undertakings. To-day it is responsible for the operation of 61½ route miles of electrically worked urban railway, 123 route miles of tramway, and practically all the motor-omnibuses of London. It has tended towards an ownership control, but as such it has no legal existence, no protection, and, equally, no special obligations. This only can be said, that it has always regarded first the public interest, and its record for the years of its existence is unimpeachable testimony as to this.

V. THE VOLUME OF LONDON TRAFFIC IN 1913.

In Relation to the Traffic Facilities.—The total passenger traffic of London in 1913 is estimated at 2,293,838,249 passengers. This total is shared almost equally between the three types of traffic facility—the railway, the tramway and the motor-omnibus. The number of passengers carried on the local railways was 423,490,553, including under this head three sections of main line railways in London issuing separate annual reports and figures. This represents a traffic of 3,781,166 passengers for each mile of route, and 1,802,087 passengers for each station provided. In the year 1907 a return was made by all the main line railways for the month of October showing the traffic which they carried into their terminal stations in London from points distant within 30 miles. Based on these figures, the total number of passengers of a local character contributed by the main line railways is estimated at 365,190,972. This represents a traffic of 636,221 local passengers for each station provided. The total number of passengers carried by railways was 788,681,525, or 34 per cent. of the grand total.

The number of passengers carried on the London County Council Tramways was 522,952,640. The number carried by the tramways operated by other local authorities is estimated at 112,888,137. The number carried by privately owned and operated tramways was 164,159,223. The total number of tramway passengers was about 800,000,000, or 35 per cent. of the grand total. This represents a traffic of 2,312,139 passengers for each mile of route, or a traffic of 287,770 passengers for each car provided. The number of passengers carried on motor-omnibuses was 705,156,724, or 31 per cent. of the grand total. In 1913 the traffic represented 202,806 passengers for each motor-omnibus provided.

In Relation to the Population.—If the total population of 8,471,146 is applied to the figure of 2,293,838,249 total passengers, the average number of journeys per head of the population works out at 271 per annum. So high a figure as this is only of recent occurrence. The year 1906, which marks the commencement of electric traction on railways and the development of the motor-omnibus industry, marks also a turning point in the volume of traffic. In this year the journeys per head of the population were estimated at 164. The rate of increase over the eight intervening years is 65 per cent.

Further illustrations are available of the movement of traffic in London. For instance, at Golders Green Station, the terminus of the Hampstead line of the London Electric Railway, where the only means of direct access to the centre of London is by railway, the average number of journeys per head of the population is 260 per annum on this line alone. This is at a distance of just over six miles from Charing Cross. At the 1901 census the population of this district was 22,450 persons. The railway reached it in 1907. At the 1911 census the population was 38,866, or an increase of 73 per cent., almost all due to the last four years. Then at Wimbledon, where there are two railways, which form the only good means of reaching the centre, the journeys taken on one railway alone work out at 154 per head of the population served, or at something over 220 for both. This is at a distance of nine miles from Charing Cross. Then again at Sutton, which lies at a distance of 12 miles from Charing Cross, where by reason of the distance, the railway is the only practicable means of transit, the railway journeys per head of the population to and from London are as high as 170 per annum. Lastly at Southend, 38 miles from Charing Cross and the nearest seaside resort to London, there is a regular flow of business traffic to and from London of over 4,000 people in a day, which works out at 43 journeys per head of the population served per annum.

A converse illustration is the volume of the traffic moving in and out of the central area, the cities of London and Westminster. The available data on this aspect are confined to the passenger statistics of the local underground railways. Out of 423,490,553 passengers carried by them, 120,533,406, or 28 per cent., travelled to and from stations in the central area. If this proportion were to apply to other types of traffic facility, it would mean that over 642,000,000 people were carried in to and out of this area. Such an estimate confirms a previous estimate of the wide difference between the day and night population of this central area, and emphasises the manner in which the unity of London is created by, and depends upon, the traffic facilities.

VI. FLUCTUATIONS IN THE VOLUME OF TRAFFIC.

Of more importance to the various traffic undertakings is not so much the total traffic to be carried as the incidence of the traffic throughout the months of the year, the days of the week, the hours of the day, an evenly-distributed traffic being at once the most easily worked and most profitable.

The Course of the Year.—In considering the effectsof the seasons on London traffic, it is necessary to sharply distingui h between the underground, or railway, system and the surface, or tramway and motor-omnibus, system, for the weather characteristics of each stand in contra-distinction to each other. The seasons of fine warm weather bring about a transfer of passengers from the protected railway services to the open motor-omnibus and tramway services, just as surely as the seasons of cold, wet weather bring about the opposite transfer. The effect of this transfer is to reduce the average winter railway traffic by an eighth. The increase on the surface systems, strengthened by the larger volume of traffic which genial weather induces, is a sixth more than their winter level. This is the most predominant feature in the shift of traffic during the year. The only other marked feature is the drop occasioned by the holiday season of August and September. The trend of traffic month by month follows some such course as this.

January is a good month chiefly on account of pleasure traffic springing from the number of entertainments, pantomimes, and plays which crowd the Christmas festival and endure to about the close of the month, and from the after-season sales of big drapery and general stores.

February is a bad month, and for all the surface systems usually the worst of the year. March, April, and May are the months during which the railways slowly weaken and the surface systems slowly strengthen. These months are marked by public holidays at Easter and Whitsuntide, when traffics are especially heavy. The close of May, the month of June, and the beginning of July form the London season. June is the best traffic month of the year all round. July is less good, although the traffic is generally sustained up to the first Monday in August, which is another public holiday. At this point the holiday drop starts with great suddenness. Everyone goes out of town that can, and business and pleasure alike languish. August is the worst month of the year on the whole. On the railways, about

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a quarter of the traffic vanishes ; on the surface systems, only a tenth. It is less marked on the surface systems because of the development of country pleasure riding that has taken place in the last two years. The poorer classes of the population, who cannot afford to go away for holidays out of town, take their brief holidays in rides out into the surrounding country. This drop continues well into September, and as the traffic comes back again it falls to the railways, for this month and October are the months in which, vice versa, the surface systems weaken and the railway system strengthens. It is a more quick transition. November is a variable month, contingent on the weather. December closes the year with a good month, due to the extensive shopping and other preparations for Christmas.

The Course of the Week.—There is nothing sensational in the course of the traffic throughout the year, and the same may be said of the course of the traffic throughout the week. Setting aside days of extraordinarily inclement weather and days of extraordinarily heavy traffic, like the annual shows and feast days, the characteristics of the week are constant. Sunday has the least traffic of any day ; on the railways only half and on the motor-omnibuses some four-fifths of that of an average weekday. Monday to Friday present little change. Wednesday and Thursday excel the other days because the mid-week shoppers' half-holiday of certain suburbs falls on one or other of these days, and mid-week distractions seem to come to vary the regular round of domesticities. Superstition militates against Friday's traffic. Saturday is the day of largest traffic, exceeding the average day by a tenth on the railways and a sixth on the motor-omnibuses. This is by reason of the addition of the pleasure traffic of a general half-holiday to the normal business traffic. The relative gains of motor-omnibus and railway indicate how much the surface systems enjoy the greater share of the pleasure riding. Throughout the week the variation in the traffic is fractional.

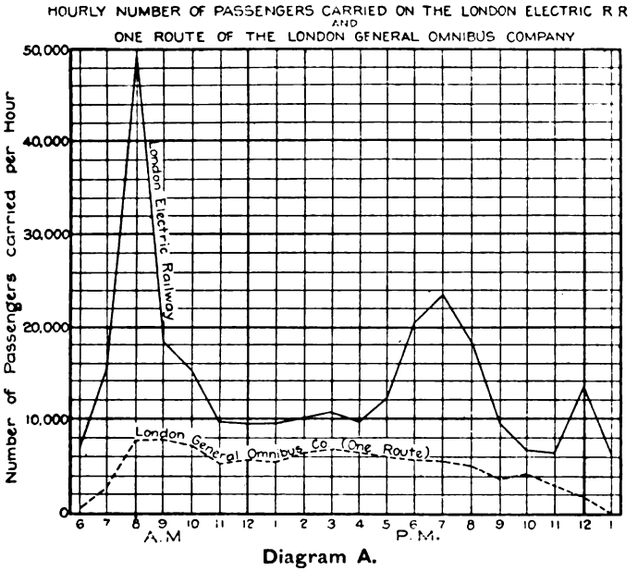

Diagram A.

A note may be added upon one satisfactory aspect of the Sunday traffic of the railways. It has been increased at a much faster rate than the weekday traffic. On the District Railway, largely as the result of advertisement, the Sunday increase over the last five years has been 25 per cent., as compared with an increase of 11 per cent. on weekdays.

The Course of the Day.—It is when the course of the day is considered that the variations become of substance and concern. At this stage the railways have to be taken separately as showing the widest divergence. Data of this sort are not available for the tramways, but it is presumed that their characteristics are similar to those of the railways. On the motor-omnibuses the divergence is never very great. A diagram illustrates the contrast. (A.)

On the railways and tramways the peak load of the morning is accentuated because of a class privilege which is deeply embedded in the traffic arrangements of London, and is consecrated by statutory enactment. This is the cheap workmen's return fare, which almost corresponds to the single journey fare at other times of the day. The outward journey must be commenced before 8 a.m. as a rule, but the return journey may be at any time of the day after noon. The wider limits of the return journey cause a better distribution of the traffic in the evening between 5 o'clock and 8 o'clock. The morning rush to business and the evening rush home have their slender counterparts in the evening rush to pleasure and the night-time rush home. The evening rush to pleasure is covered by the evening rush from business, but the night-time rush home, from 11 o'clock to 12 o'clock midnight, is clearly visible on the diagram.

The motor-omnibus, when operating in conjunction with other means of transit, has not a peak load. One reason is the absence of the workmen's return fare, which cuts it off from a fair share in the traffic before 8 o'clock in the morning. Another reason is the smallness of the units required to be filled with traffic, which allows of a closer adjustment to demands. A third reason is the special feature of motor-omnibus traffic, in that it consists of traffic casually picked up all day long, so long as there is traffic in the streets. The motor-omnibuses are always reasonably full throughout the day. At the time of peak load they are quite full. They cannot overcrowd like railways and tramways, for the terms of their license from the police forbid it. To-day, on account of the withdrawal of omnibuses for the war they are specially allowed to stand five passengers inside as a temporary measure.

It is in the variations of the day that the operating problem of accommodation arises, where the ratio runs from one to five. Yet for all this it is not an acute problem in London. The worst point for overcrowding on the railway system is at Whitechapel in the East End, and is almost wholly due to the peculiar workmen's privilege. A chart (B) shows how bad this is, and by way of comparison another chart (C) for the West End of the same railway, for the corresponding point of maximum traffic on that side, shows how good it is.

Much effort and many improvements have gone towards the securing of this result, and the problem has been kept within manageable proportions.

VII. IMPROVEMENTS IN RAILWAY CAPACITY.

Electric Traction and Automatic Signalling.—The District Railway commencing as a shallow steam railway and being converted to electric traction in 1905, first of any railway in London, has the longest and most interesting record of improvements and progress. The main section of this railway, over which all trains serving the central area must pass, extends from Mansion House Station on the east to west of Sloane Square Station on the west, a distance of four miles. It consists of two tracks, one for each direction. At points eastward of Mansion House Station, which has terminal facilities, it diverges into three separate branches, and at points westward of Sloane Square Station it diverges into six. From and to each of the six westward branches services of trains run through on to the main section. With trains converging at so many points, the problem of timing the trains in, to give a uniform interval at as many points as possible, is difficult in the first place ; but even more difficult is the problem which arises fresh with every day's working of bringing the trains to the converging points at the correct moments amid all the little unevennesses and mischances which will occur whatever care is exercised.

Under steam conditions, the best result was a succession of 18 trains in the hour in each direction over this main section. Under electric conditions, but chiefly due to the substitution of a system of automatic signals giving shorter block sections in place of the old manual signals, the number of trains in the hour each way was raised to 25, varying from 24 to 27 with successive time tables in 1906-7.

In 1907 the need was felt for some increase in the service provided if the development of the traffic was to be encouraged. The change in motive power had not so far produced a corresponding change in the alertness and dispatch of the train and station staff. Experiments were made in the way of starting the trains from stations and in the way of securing a quicker rate of unloading and loading, and at the close of 1907 the number of trains reached 31 in the hour.

The year 1908 brought a reconsideration of all the branch services which went to piece together the total service on the main section, and, by a rearrangement of these services to avoid possible clashing and delays, the trains crept up to 35 in the hour. During this period the platforms throughout the line were reconstructed and lengthened to take eight cars as a maximum train length, and in the then physical state of the property it was not practicable to carry the frequency to any higher pitch.

The Elimination of Flat Junctions.—About the year 1910 a series of works was commenced having for its object the amelioration of the property and the raising of the standard of operation to that of the latest constructed railways. The first work was the re-designing of the Mansion House Station. This station consisted of two through tracks placed between two island platforms on the outside of which were two terminal tracks. To use a terminal track involved, either in entering or leaving, the blocking of the through tracks in both directions. As re-designed, it consists of a terminal track between the two through tracks, with a relief siding on the outside used for storage only, and by this means the blocking of both tracks is avoided in ordinary train working.

Concurrently with this alteration, and proceeding during the succeeding year, steps were taken to overlap the block sections throughout the main line, so that the distance between trains approaching stations was reduced to the minimum space required to ensure safety under the given working conditions. In November, 1911, the number of trains in the hour was 37 in each direction.

But the chief obstacle to progress was the existence of so many junctions on the flat where trains, crossing over from the branch to the main line, blocked the tracks in both directions. The policy of transforming the flat junctions into flying junctions where, by differences of level the tracks for one direction are carried over or under the tracks for the other direction, dates from the year 1910. In this year the junctions at Acton Town, an outlying point, were completed.

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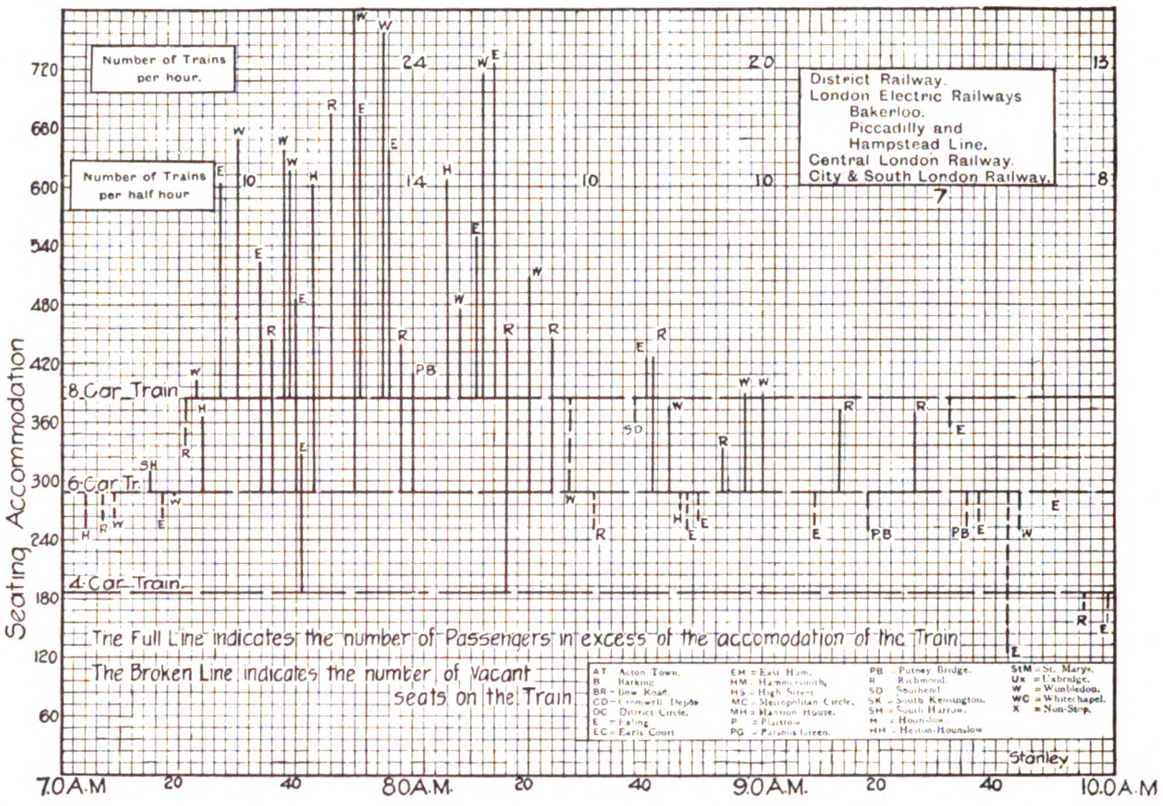

Diagram B.—Train Loading, taken at Whitechapel on the West Bound Road, June 20, 1914.

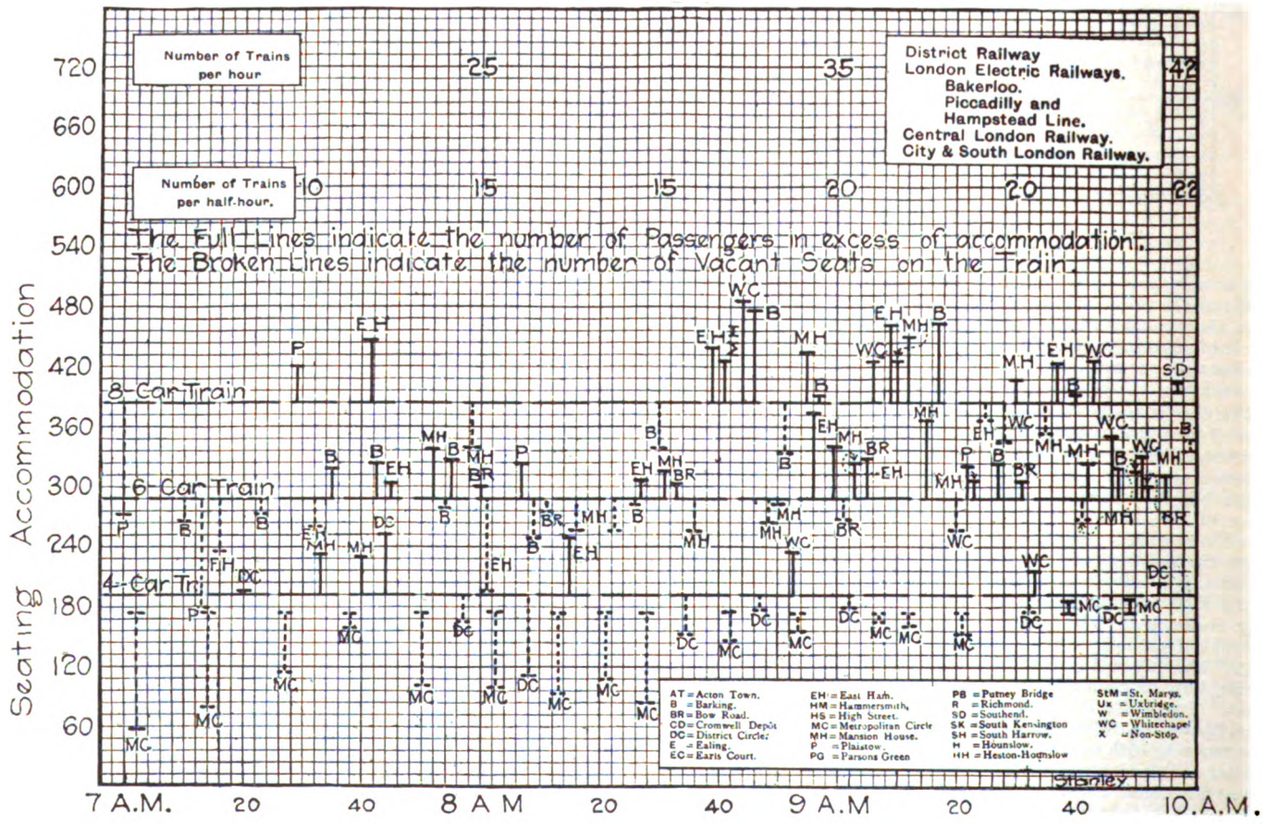

Diagram C.—Train Loading, taken at Sloan Square on the East Bound Road, March 9, 1914.

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In 1911 the junctions for the Richmond line were similarly treated, and coupled with a doubling of the line to four tracks over a short length. The benefit of this was felt in the increase of the main line trains from 37 to 40 in the hour. In 1914 the junctions at Earl's Court were similarly treated, and again coupled with a short doubling of the line, and benefit again accrued in the increase of the trains from 40 to 43, at which figure it now stands.

When all the schemes for improvements in contemplation are executed it is expected to approach to a capacity of 50 trains in the hour in each direction as a maximum.

Only on one other railway in London is there a service at so high a level, and that is on the Hampstead line of the London Electric Railway, where the frequency is 44 trains in the hour at the busiest times. At practically every point on the urban railway system it is possible to afford traffic facilities adequate to the volume of traffic requiring to be carried. This does not mean that there is no overcrowding, for overcrowding, in the sense of people standing in the cars, must be regarded as a permanent feature of the rush periods of urban traffic operation. But the overcrowding, under all normal or expected circumstances, is not such as to result in discomfort or undue congestion.

The Problem of Peak Loads.—The reason why the problem of peak loads is not acute in London, as in so many cities, is twofold. In the first place, the development of London has taken place with considerable uniformity in all directions, and, while there is a greater development and a greater traffic on the east and west axis, it is not totally disproportionate to the development and traffic of the north and south axis. The passengers that come into the central area come in from all sides, and are distributed over many lines of approach, so that the volume to be handled on one line of approach does not present the difficulty which a restriction in possible lines of movement would create. In the second place, there is some public advantage in the duplication of the means of transit, which is so common a feature of London, so that on a given line of approach there are always two possible alternatives of railway, tramway or motor-omnibus, and in many cases all three.

In this connection the adaptability of the motor-omnibus to a wide distribution of a stream of traffic is not to be overlooked. For example, the stream of vehicles passing through the principal street between Oxford Circus and Bond Street consists of 14 different routes, which fan out on either side, and afford connections to quite a number of suburbs direct, in a way in which a tramway or a railway involving expensive initial construction could not afford to do. On the tramways the peak load problem has been met by the addition of trailer cars. The use of trailer cars is open to argument in London on the grounds both of safety and efficiency, and the practice cannot be considered as finally settled.

Looking ahead, there is no reason to anticipate that density of traffic will ever become a critical factor in determining a policy for the development of traffic facilities in London. The determining factor is not likely to become the mere movement of quantities of passengers to the sacrifice of other factors.

VIII. THE TRAFFIC CLASSIFIED AND DISTRIBUTED ACCORDING TO THE RATE OF CHARGE.

The acute problem of London is the problem of the fare. Some attempt has been made to describe the piecemeal and disconnected way in which the traffic facilities of to-day have been brought into existence, and adventures in fares have gone with almost each. There is a historical background to London traffic, and, interesting as history is, it enshrines in the present relics of the past which stand tenaciously in the way of a harmonious and coherent system. There is no "fares system" in London. The traffic may be analysed into three principal classes and over many rates of fare, but there is no clear definition about any of the figures in relation to the fares charged.

On the Motor-Omnibuses.—The motor-omnibuses have only one price for a journey, that of the ordinary single fare, varying according to the length of the journey. A few transfer tickets, limited to a definite exchange point, where a short connecting service is run specially to link together two important groups of routes, serve in their scantiness to enforce the general principle of a payment on each motor-omnibus for the ride taken. A few cheap return tickets, copied from the tramways, are again too insignificant to count. Over 99 per cent. of the traffic is carried on a straight ordinary fare.

The distribution of this traffic over the different rates of fare shows that 12 per cent. paid a halfpenny and 57 per cent. a penny, so that 69 per cent., or over two-thirds of the total, is short-distance traffic.

Above this price 9 per cent. paid three-halfpence; 13 per cent., twopence; 3 per cent., twopence-halfpenny; 3 per cent., threepence; and 3 per cent., more than threepence. The average receipt from the whole of the traffic is 1·33d.

On the Tramways.—On the tramways there are two distinct classes of passengers. There is the workmen's traffic, travelling on cheap return tickets at fares equivalent to about half the ordinary fare, in pursuance of a statutory privilege to which reference has already been made; and there is the ordinary traffic corresponding to that of the motor-omnibuses. The workmen's traffic is almost 10 per cent. of the whole on the London County Council system. Latterly an extensive experiment has been carried out in the way of cheaper return tickets for ordinary passengers, but so far no results have been published to show whether this has been successful. At the same time, transfer tickets have been introduced, but again with no publication of results as to use or abuse. These experiments arise out of an attempt to counteract the effect of the motor-omnibus competition on the tramways traffic.

The distribution of the traffic on the London County Council tramways, workmen and ordinary together, shows that 32 per cent. paid a halfpenny and 46 per cent. a penny; or that 78 per cent. is, in this case, in the category of short distance traffic, a somewhat larger proportion than that of the motor-omnibus traffic above, due to the inclusion of longer distance traffic travelling under the cheap rates for workmen. Above this price, 7 per cent. paid three-halfpence; 8 per cent., twopence; 1 per cent., twopence-halfpenny; 4 per cent., threepence; and 2 per cent., over threepence. The average receipt from the whole of the traffic was 1·01d., and for the ordinary traffic, exclusive of workmen, 1·12d.

On the Railways.—On the railways there are three distinct classes of passengers. There is a statutory workmen's traffic, as on the tramways. There is a large commuted traffic travelling on season tickets, calculated at 10 or 11 fares for a week's riding, and issued for one or three months as a usual period. There is no limitation in the number of rides which may be taken on a season ticket, and, from observations made on urban railways, the number approaches an average of three per day, so that the discount on this class of passenger is quite appreciable. Lastly, there is the ordinary traffic again.

Taking the London Electric and Metropolitan District Railways as typical of the urban system, then 16 per cent. of the total traffic falls into the workmen's class and 8 per cent. falls into the commuted class, leaving 76 per cent. of ordinary passengers. On some railways there is a further class distinction into first and third, but this is of little significance, and may be ignored. The first-class traffic is some 4 per cent. of the total ordinary traffic.

It is possible to give figures for the London Electric Railway, distributing the ordinary traffic over the different rates of fare. There are no halfpenny fares on the railways; the penny traffic is 25 per cent. of the whole, contrasting strongly with the proportion on the surface systems. Above this, 9 per cent. paid three-halfpence; 32 per cent., twopence; 5 per cent., twopence-halfpenny; 23 per cent., threepence; and 6 per cent. over threepence. The average receipt from the whole traffic of this railway is 1·68d., and for the rest of the traffic, excluding the workmen, 1·86d. The inference to be drawn from the figures is that the railway, as would be expected from its superior speed, meets the requirements of the long-distance passenger.

IX. THE FARES CHARGED.

The key to the fares situation of London is the rate of charge for ordinary passengers, as the fares charged to workmen and other favoured classes are based finally in relation to the fare for the ordinary passenger.

Factors Affecting the Amount of the Ordinary Fares.—There is no one person who can fix the ordinary fares of London as he likes, so many people are interested in them, and so many factors, almost as many as there are people, come in to govern the possible development of a uniform situation. Some of these factors may be indicated here, In the first place, railways and tramways have certain fares fixed for them by statutory enactment. In the second place, there are the anomalies surviving from the past, and confirmed, in a conservative mind, by daily use and wont so as to be almost past disturbance. There are numbers of agreements made in early days affecting small points in fares in an incidental manner which have a wider effectiveness in these later days than was originally contemplated. In the third place, there is the continued conflict of interests in London traffic which led in the past, and may again lead in the future, to fare cutting, not, may be, universally, but only partially and locally. Latterly the policy of the London County Council, as the tramway authority, has been towards reductions of fare over all its system, and this policy raises a curious question having regard to the financial condition of its tramways. These tramways are not necessarily worked under ordinary commercial conditions, as there is behind them a financial guarantee out of which to meet the losses by an addition to the public rates. The payment of rates falls on fewer shoulders than the payment of fares, and there must be a constant temptation towards a cheapening of the cost of travel. This temptation is the more insidious because it is a patent fact that, up to a point, the cheaper the fare the greater the volume of traffic and the better the general result. This has been the experience obtained in the whole series of fare reductions, but only up to a point. There is a saturation point for traffic, and to over-pass this point with further reductions is only to suffer loss; but against the risk of this there is in existence no guarantee. Lastly, there are the efforts of different experts to so adjust the fares as to charge what the traffic will bear under the particular theories which they may chance to hold.

Coinage in Relation to Fares.—One factor affecting the amount of a fare is deserving of more detailed consideration, because it has a positive determining effect, and that is the coinage of the country. It is necessary to take note of what are the common coins of the country, and the relation existing between the several denominations of coins. In London, the common coins are the penny and

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halfpenny and the farthing. The numbers of these coins in circulation at the close of the year 1911 was :—

Pence	836,950,560
Halfpence	507,821,280
Farthings	211,060,800

The figures are given to show that the halfpence and farthings must still be counted as effective coins. The farthing has no relation to-day to charges for passenger traffic, and so it may be ignored, but the halfpenny has, and calls for attention. There are not two pennies in circulation to each halfpenny. The halfpenny press has an enormously greater circulation and popularity than the penny press. The halfpenny cannot be ignored. These are bronze coins. The lowest denomination of silver coin is the threepenny bit, and the next highest, the sixpence. Of threepenny bits, there were issued in the last ten years, 54,000,000, and of sixpences, 80,000,000. The threepenny bit is not to be regarded as a convenient coin, owing to its small size. It has a lucky significance, and certainly tends to be easily lost. On the other hand, the sixpence is a coin too highly valued to be of much use in connection with a scheme of charges for urban traffic, so that the pertinent factor has to do solely with pennies and halfpennies.

Costs of Operation per Passenger.—While it cannot be regarded as a factor determining the amount of the fares, yet the amount of the fares must have some relation to the cost of operation per passenger. For the year 1913, the results of operation of several of the companies working in London may be set out in tabular form to illustrate this point :—

	Gross Earnings per Passenger.	Expenses per Passenger.	Net Earnings per Passenger.
	d.	d.	d.
London Electric Railway	1·68	·83	·85
Central London Railway	1·60	·94	·66
City and South London Railway ...	1·54	·97	·57
District Railway	1·83	·88	·95
London General Omnibus Company, Limited	1·33	·94	·39
London County Council Tramways ...	1·01	·73	·28

While not any one of these figures can be looked upon as a stable indication of the level of cost, the sequence of them may be taken to tentatively point to the fact that for the railways, at any rate, the cost of operation swallows so much of the penny as to make an average receipt of this sum inadequate for the payment of a reasonable rate of interest on the capital invested in them, and that while, for the tramways and motor-omnibuses, an average receipt of approximately a penny enables them to fairly discharge all their obligations, it leaves no margin of security against mischance or ill-luck, nor any margin for the future development of the system, which is a matter of urgent importance. On the whole, it is necessary that the average receipt from passenger traffic in London should exceed a penny, and that on the railways, with the growth of the metropolis and the increase in longer distance travel, it should approach more closely to twopence than it now does. The level of average fare for the two opposed systems, the underground and the surface, is disparate, and this adds another complexity to any consideration of the fares problem.

The Existing Scale of Fares.—Sufficient data have been given to show that, once and for all, London is prevented from adopting a flat fares scheme similar to that which obtains in most cities of America. The flat fare, to please, would have to be a penny, for almost 70 per cent. of all the existing traffic is carried at or below this price, and the penny is not practicable traffic politics.

A flat fares scheme has been tried in London on the Central London Railway. From the date of its opening until 1906, it persevered with a uniform charge of twopence. In this year, it carried 36,722,497 passengers, of which 11·65 per cent., or 4,278,171, were carried over short distances up to three stations, and 24·21 per cent., or 8,890,516, were carried over long distances exceeding nine stations. From 1906 onwards, this railway has felt particularly the competition of other railways and of motor-omnibuses, and has had a constantly declining traffic. In 1908 it had given up its original single fare of twopence in favour of two fares, twopence and threepence, and in 1913 had gone further still with the introduction of a penny fare. In this year, the penny passengers numbered 15,459,827, which, compared with the 4,278,171 of 1906, shows over three-fold growth. The threepenny passengers numbered 2,907,795, which, compared with the 8,890,516 of 1906, shows an exactly inverse decline. Here again the large influx of penny passengers shows the public demand for a ride at the price, so that, failing a penny flat fare, a differential scheme of fares is inevitable, and this is the scheme which London has.

The differential scheme of fares adopted in London has relation to distance as its criterion. There are critics of this, in that distance has a varying value in different quarters of the metropolis. For instance, on the short north and south axis the fares tend to be higher than on the long east and west axis, because there is a feeling that the two should correspond in price. Again, in the prosperous west-end, as opposed to the working class east-end, the rate of fare per mile tends to be higher, though this is more a converse illustration of a variation in the value of money. Other criteria might be suggested as a basis for a differential scheme, such as the value of the service rendered, the time at which the journey is to be performed, a geographical arrangement of zones ; but all these are foreign to the existing practice of fare making, and at enmity with existing fares.

In order to illustrate the scale of fares which is now in force, the London Electric Railway may be taken as representative of the railway system, and the London General Omnibus Company as representative of the surface system. Taking the fares of these companies and averaging the distances offered for each separate fare at each denomination, it is possible to make a comparison of the relative distances carried by each of them for a given price. This is shown in the following table :—

Rate of Fare.	L.E.R.	L.G.O. Company, Limited.	Difference.
	Miles.	Miles.	Miles.
1d.	1·4	1·7	·3
1½d.	1·9	2·4	·5
2d.	3·2	3·4	·2
2½d.	3·9	4·3	·4
3d.	5·1	5·2	·1

The result is that not only is there a differential scheme of fares in London, but two such different schemes—the one for the railways and the other for the surface systems. The discrepancy between the two schemes is less marked in average figures than in actual direct comparisons, for an average always tends to hide the extremes, but for the purpose of this comparison it is a fairer figure.

The discrepancy between the two schemes is greatest at the lowest fares and tends to become less as the fare increases, until at over threepence the railway is as cheap and often cheaper than any other means. This arises from the railway practice of adopting an accumulative or sliding scale of charges, in contrast to the older practice of the motor-omnibus and tramway of arriving at the higher fares by a simple addition of the lower ones. In imitation of the railways, the surface systems have copied the sliding or accumulative scale in part, and are tending to copy it extensively. As their base distance at one penny is greater than on the railways, the extension of their higher fares tends to a very great degree of cheapness, so that fares get to be at rates much under even a halfpenny a mile.

X. THE FARES PROBLEM.

The Equalisation of Fares.—It will be recognised how exceedingly intricate and complex is the fares problem that waits solution in London, and how full of pitfalls are the paths open to the reformer. This very complex situation is an explanation of one great source of struggle for London traffic. There is no rest and no finality in any dealing with fares, and month by month changes take place in the way of closing up the gaps on one side and, again, of widening the gaps on the other side. There is no standard or definition of what is a reasonable or proper fare to which the many people taking part in the game can refer. The statutory level is a penny a mile, but this is in excess of what is a practicable level. It may be generally stated that the railway fares are, if anything, on the high side, and for several years now, as opportunity offered, a succession of steps have been taken by way of bringing them down to a better level. These steps have not enabled them to overtake the level of the surface fares, and there are still many steps to take, but the whole tendency is towards an equalisation of fares, at any rate, at the lower prices. There seems little reason why, up to threepence, the rate of charge for all systems of transit should not be approximately alike. Over threepence the advantage in rate of fare might reasonably rest with the railways, as they only are in the position to meet the requirements of the long distance traffic. Meanwhile the multitude of discrepancies continues, and some fares have fallen below a remunerative level. Sir Thomas Gresham, in the Elizabethian time, made the discovery that spurious money always tended to oust good money from circulation, and a similar effect may be traced among fares. A low fare, or rather a bad low fare, always tends to eat into all the other fares in its neighbourhood, and for this there is no cure. This is the great pity of the mistakes. The downward path is the easy path, but to put a fare up calls for much courage and obstinacy. It is a very rare occurrence that a fare is put up.

Excessive Differentiation.—The differentiation in fare is also carried too far. The jump in price from one penny to twopence is 100 per cent., and the three-halfpenny stage is useful in breaking this down. The jump in fare from twopence to threepence is 50 per cent., and the twopence-halfpenny stage may also be useful as a bridge here. People have a tendency to save their halfpence, even by getting out at a point short of their real destination to save passing into another fare stage, and at a penny rise this tendency is accentuated. The jump from threepence to fourpence is only 33⅓ per cent., and at this point the full penny rise is only proportionately equivalent to the previous halfpenny rise, and the halfpenny stage does not seem to be warranted. A fares scale is thus possible with the following denominations:—One penny, three-halfpence, twopence, twopence-halfpenny,

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threepence, fourpence, fivepence, sixpence. Beyond sixpence there is scarcely need to go, for all regular traffic. In fact, fourpence seems to be the limit fare. Regular traffic from beyond the fourpence limit is almost wholly commuted traffic, and the commutation works out to an extended fourpence limit and no further.

The application of these denominations is further complicated by the problem of the choice of the accumulative or the simple additional scale to which reference has already been made. The accumulative scale has a real value in affording ever widening zones round the point from which the reckoning is taken, for every increase in price. It affords much greater scope for development without insisting upon a low initial basis. It must be regarded as a fixed element in any London scheme. It has the defect of obscuring the basis of charge, so that there is no sure and easy way of advertising to the public what the fare is between any two stage points or stations. It is easy to add fares together, but difficult to adjust them in accordance with some progressive scheme of discounts.

The Characteristics of a Fares System.—This point brings up the question of what are the characteristics of a good system of fares. That they should be even in their incidence, sure and settled in their composition, known in their existence, and simple in their arrangement, seem the four cardinal qualities. None of these qualities are present in the London scheme as it is to-day, and there is the great drawback and the great puzzle—a new fares system for London, which will give the public what they want, which is as much for their money as they can get; and give the traffic companies what they want, which is as much business as they can carry; and give the shareholders what they want, which is a fair and steady dividend.

XI. THE FINANCIAL RESULTS OF 1913 AND THE PROSPECTS FOR THE FUTURE.

The Heavy Capitalisation and the Low Return.—A vast deal of money has been sunk in the provision of the traffic facilities of London, amounting to over £90,000,000, without bringing into account the expenditure of the main line railways within the area, for this cannot be ascertained. Of this amount £66,000,000 is in the position of ordinary capital sharing the net sums earned, whether they be great or small, and the unfortunate fact remains that they are small—too small to place this great enterprise on a prosperous or satisfactory footing. The total amount available for dividends on the ordinary capital was in 1913 £1,390,000, or only sufficient to pay a dividend of just over 2 per cent. all round.

Of the amount spent, £63,000,000 represents the urban railways. The largeness of this figure is due to the high cost of construction per mile of the original deep-level tube railways. The London Electric Railway has cost £785,000 per mile of railway open for traffic.

Certain sections of the District and Metropolitan Railways, in the central area, have cost as much as £1,000,000 per mile. This is a terrible sum to pay a dividend on out of penny fares.

The only real remedy for this is expansion of traffic.

Expansion of Traffic.—Large as the traffic in London is, it is not so great as that of other great cities of the world, proportionately to its size. Greater New York, for example, has a population which travels 338 times in the year per head, and there are several other big American cities approaching the 300 line. In Europe, Greater Berlin has a population that travels 293 times. It may confidently be expected that London will increase its journeys per head from 271 up to 300 in the next few years, and it is a piece of arithmetic what this means to the existing companies. To pay 4 per cent. on the capital now invested, that is to realise a net earning of £1,390,000 more after allowing for increase in expenses, requires an extra 36 journeys per head of population at the present average receipt per passenger.

But the population is not stationary, and so, with increased facilities, a hopeful conclusion may be looked for. There are two limits set to the traffic expansion, the limit of fare and the limit of time occupied on the journey. London is not yet developed to the area of fare limit or of time limit, so that there is ample room for growth. The fare limit has been indicated at fourpence. The time limit may be set at 40 minutes. The time zone is capable of greater extension by the adoption of various operating expedients, such as faster train equipments, non-stopping and through express connections.

Advertising for Traffic.—People need to know what the traffic facilities are if they are to use them freely. Ordinary people will only take the trouble to learn on their own account the way to and from business or the places of their regular resort. If they are to learn much else, they have to be told over and over again in different ways until it is stored in their memories. This is the aim and purpose of advertisement.

It has been the policy of the Underground Electric Railway Company of London, Limited, to make a liberal use of the arts of advertisement in connection with its many traffic undertakings. To this end, millions of maps of the Underground system have been printed and distributed, and maps of a more permanent character in glass or enamelled iron have been fixed where they can always be seen. Direction signs and notices with a specific device have been placed at important street corners, at sports grounds, at amusement centres, at main line stations, and everywhere where people congregate, in so far as permission was obtainable on reasonable terms.

Picture posters and leaflets are issued month by month of current interest, and containing such novel elements as have come to hand. Notices are placed in the newspapers and, generally, an extensive campaign in the way of dissemination of news and information is always being carried on. To this campaign is to be attributed part of the growth in London traffic, and from it more growth is to be anticipated in the future. It has also served to establish in the public mind a feeling of goodwill, which is not one of the least assets. It is common opinion in London that the advertising of this group of companies is of remarkable and noteworthy interest. It may therefore be said to have fulfilled its aim and purpose.

Conclusion.—But unless to the detailed solution of the commercial and operating problems of the movement of traffic there can be brought a spirit of co-ordination and co-operation, the solution can never be complete or conclusive. Only in this way can the development of the traffic facilities be carried out with economy, and the traffic conserved to afford opportunities for dividend on the money already sunk in their provision.

THE WAR AND TRAMWAY TRAFFIC.

MOTORMEN OF MILITARY AGE.—TRAMWAYS AND THE MUNITIONS ACT.

A joint deputation from the Tramways and Light Railways Association, the Municipal Tramways Association, and the British Electrical Federation recently waited upon the Reserve Occupations Committee for the purpose of urging the importance of retaining a sufficient number of motormen and other skilled men in order to carry on the various tramway services, which, in many cases, involves the conveyance of men to munitions and other Government workshops. Returns were submitted showing that there are 11,638 drivers employed on municipal tramways, of whom 7,000 are of military age. Company undertakings employed 3,356 motormen, of whom 1,983 are of military age. The number now employed is considerably below the total employed in normal times. A number of the men given as being of military age have been rejected by the military authorities on various grounds.

Chesterfield Council have made an application to the Ministry of Munitions for the tramways undertaking to be constituted a controlled establishment. It is doubtful whether the whole undertaking can be so dealt with. Under the amendment of the Munitions Act, adopted by the House of Commons an January 4, the definition of munitions work is extended to light, power, and tramways facilities, "only in cases where the Minister of Munitions certifies that such supply is of importance for the purpose of carrying on munitions work, and the erection of buildings, machinery, and plant required for such supply."

Sir Wm. Clegg, chairman of Sheffield Tramways Committee, informed the Corporation on January 12 that tramway employment now being regarded as a "reserved occupation," they had persuaded the Board of Trade to exempt the skilled men in their service from being called to the colours. They were endeavouring to get the same treatment for the drivers. So far they had not succeeded, but it seemed to him a necessary corollary to what they had already obtained, for, without the drivers, the work of the skilled men would be useless.

West Hartlepool tramways manager has applied for postponement to a later group in the cases of motormen who were affected by the first proclamation calling up the Army Reserve.

Burnley Council have authorised the tramways manager to ask the recruiting tribunal for the retention of the motormen attested for the Army Reserve.

Thornley Council have decided to support the Tramways Company in obtaining exemption or postponement from army service of their employees. If any drivers are taken away the service between Wheatley, Thornley, Coxhoe, and Durham is threatened with suspension.

The training of volunteer motormen at Birmingham has advanced sufficiently to allow of their services being utilised on the cars during the week-ends. Fifty professional and business men are thus engaged.

In accordance with the Home Office Order for taking precautions against airship raids, the reduced lighting regulations for vehicles became applicable to a largely extended area on January 10.

In consequence of the new lighting order, the speed of the cars has been reduced at Birmingham from a maximum of 16 to 10 miles per hour. The average speed has been lowered from 7½ to 6½ miles.

Metropolitan Association of Electric Tramways Managers.—A meeting of the members was held on January 14, at the Municipal and County Club, Whitehall Court, Whitehall, S.W., when the following were present:—Messrs. Ullmann (East Ham), chairman; Schofield (Leyton), vice-chairman; Moffet (West Ham); Harvey (Ilford); Mackinnon (London United); and Goodyer (Croydon), hon. secretary. Letters of inability to attend were received from Messrs. Fell (L.C.C.), Bruce (L.C.C.), Murray (Walthamstow), Stokes (Bexley), Hammond (Metropolitan Electric), Williams (Erith), and Mason (South Metropolitan). Various matters of interest were discussed.

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FINANCIAL REPORTS AND MEETINGS.

Electrical Utilities Corporation.—A quarterly dividend of 1¼ per cent. on the preferred stock is announced.

Brazilian Traction Company.—The Brazilian Traction, Light and Power Company have declared a dividend of 1 per cent. on the ordinary stock.

Rio de Janeiro Tramways.—The directors of the Rio de Janeiro Tramway, Light and Power Company have declared a dividend of 1¼ per cent. on the capital stock.

London County Council Tramway Receipts.—At the London County Council, on January 25, the Highways Committee reported that the tramway receipts from April 1, 1915, to January 12, 1916, were £1,817,620, as against £1,821,244 for the corresponding period of the previous year, a decrease of £3,624. For the five weeks ended January 12, the number of passengers was 54,291,778, an increase of 1,431,465 over the corresponding period of 1914-15, while the receipts were £228,425, an increase of £6,251.

A Grant from Sheffield Tramways Increased Profits.—Under the special powers given in the Sheffield Corporation Tramways Act, the Tramways Committee recommended that a grant of £5,000 should be made to Sheffield University in view of its valuable war service. When the proposal came before the City Council on January 12, it was opposed by Councillor Neal, who said that last year there was brought in to the credit of the rates from the tramways £34,497. This year the committee had given the Finance Committee notice that they must expect a reduction of about £11,000 on that sum, subject to further problematical increases in wages and to the sum which they would be charged for excess profits. Sir William Clegg in reply said the main point was whether they could make the grant out of their increased profits. After taking into account all the increased expenditure, including increases in wages, the net increased profit for the half-year ended September 29 last was £11,885, and by the end of the financial year ending March 25 they would have an increased net profit over the previous year of nearly £20,000. The recommendation was agreed to.

Edinburgh and District Tramways Company.—The statement of accounts for the year ended Dec. 31, 1915, shows total receipts £311,877, and expenditure £283,757, as against £312,990 and £276,672 respectively in 1914. The expenditure included £114,174, for Corporation charges, for rent, etc. On the profit balance of £28,120 there was a decrease of £8,198, as compared with the year 1914. Receipts per mile run were equal to 11·63d., and the expenditure to 10·58d., while the profit equalled 1·05d. per mile run. The percentage of expenditure to receipts was 90·98. The number of miles run was 6,437,644, a decrease of 226,337, and the passengers numbered 66,516,137, being a decrease of 1,086,779. Out of the sum of £3,193 at the credit of the preferred shareholders, the directors recommend the payment of a dividend at the rate of 5½ per cent. per annum, and an additional dividend of 1½ per cent. for the year. A dividend of 2s. per share is recommended out of the sum of £2,892 at the credit of the deferred shareholders, leaving £1,142 to be carried forward to their credit. Nearly 500 of the employees are serving with the colours, and £5,432 was paid to dependents.

Effect of East London Railway Electrification.—The report of the East London Railway Company for the year ended December 31, 1915, shows a marked increase in passenger traffic since the lines were electrified in June, 1913. The number of passengers in 1913 was 5,149,064, in 1914, 6,172,121, and in 1915, 8,497,284. Owing to the railway now being under Government control, the receipts and working expenses cannot be given. At the previously ascertained average rate of 1·27d. per each passenger, the passenger traffic should now yield about £45,000 per annum. Owing to largely increased bookings to and from the two New Cross stations, which afford relatively full mileage, the rate is, however, probably higher. The passenger lifts at Wapping were brought into use on October 4, thus rendering unnecessary the ascent or descent of 100 steps, and largely increasing the bookings. The lines operating by electric traction include 3 miles 58 chains of double line and 25 chains of single line. Presiding at the annual meeting, Lord Claud Hamilton referred to the great increase of traffic. While in 1912 they carried 4,224,059 passengers, the number last year was 8,497,284. It might be said that the war had had something to do with the increase owing to munition workers and other people using the line, but he believed it to be rather due to the facilities given, especially for through booking on the Metropolitan and District Railway.

Yorkshire (West Riding) Electric Tramways Company, Limited.—The eleventh ordinary general meeting was held on January 21 at the offices of Messrs. Leon Brothers, 31, Throgmorton Street, E.C. Sir Herbert S. Leon, Bart. (chairman), presided, supported by the directors, Mr. George E. Leon, Mr. B. Newgass, and Mr. E. Remnant. The Chairman moved the adoption of the report and accounts. He pointed to the growing character of the company's business, the passengers carried during the year being 11,602,483, and mileage 1,763,702, as against 10,716,858 and 1,778,509 respectively. The revenue amounted to £81,086 10s. 9d., against £74,110 2s. 6d. for 1914, but the working expenses had increased by £3,474. The figures in the report showed the progressive way of the business, the increase being satisfactory and, so far as they could tell, being in no way due to the war conditions. The company was now reaping the fruits of the foresighted policy adopted in years gone by. They had always looked ahead and done their best to encourage traffic. He referred to the difficulties encountered in carrying on the services owing to the loss of so many experienced men, a matter which showed itself in the compensation account, and expressed regret that at the outbreak of the war the Government had not devised some scheme for protecting and maintaining the public utility services so necessary for war workers. The labour difficulty had now become acute, and the staff changes in a month numbered 267, against a normal 30 among some 300 employees. Mr. G. E. Leon seconded, and a discussion followed, in which Dr. Woody, Messrs. Taylor, Davenport, C. Lock, Green, and others took part. Considerable praise was accorded the Board on the successful working of the undertaking and the devotion of Mr. Harry England (general manager and secretary) and his staff, the only criticism being the suggestion as to dealing with past arrears and interest on preference shares. The chairman promised the matter should have the continued consideration of the Board, whose policy was to do nothing at the present moment to impair the admitted financial soundness of the undertaking. Sir H. S. Leon, Bart., and Mr. B. Newgass were re-elected to the directorate. The report recommended a dividend of 6 per cent. on the preference shares, carrying forward £15,054. The sum of £12,962 had been set aside for depreciation.

DUBLIN UNITED TRAMWAYS COMPANY.

The report for the year ended December 31, 1915, shows that £64,939 is available for distribution. The directors recommend the payment of a dividend of 6 per cent. per annum less income tax on the preference shares, and a final dividend at the rate of 5 per cent. less income tax on the ordinary shares for the half-year ended December 31, a sum of £18,000 to be set aside towards renewal of rails, and £5,000 to the reserve and renewal funds. The appended summary of the accounts for the past three years shows that the business has been well maintained since the outbreak of war:—

	1913.	1914.	1915.
RECEIPTS—			
Traffic receipts	£284,816	£306,083	£317,762
Parcels delivery	5,769	7,129	7,467
Advertisements	4,132	4,969	4,143
Carriage of goods	1,025	1,551	1,874
Other receipts	1,989	2,164	2,653
Total receipts	297,731	321,896	333,899
EXPENDITURE—			
Working and general expenses...	172,604	184,625	201,836
National insurance	881	945	961
Repairs to cottages	700	868	1,235
Parcel delivery expenses ...	3,102	3,934	4,400
Goods carriage expenses ...	572	868	951
Total expenses	177,859	191,240	209,383
Balance on working	119,872	130,656	124,516
Balance from last account ...	11,258	9,958	11,366
Interest	1,982	2,076	1,902
Total balance	133,112	142,690	137,784
DEDUCTIONS—			
Interest on debentures, etc. ...	26,373	26,856	25,421
Wayleaves	15,241	14,427	13,518
Payment to Howth Company ...	3,000	3,000	3,000
Renewals at sub-station ...	458	360	—
	45,072	44,643	41,939
Balance available for division ...	88,040	98,047	95,845
Dividend on preference shares 6 per cent. for year	33,900	33,225	31,200
Interim dividend on ordinary shares for half year	18,645 (6 p.c.)	15,469 (5 p.c.)	14,781 (5 p.c.)
Final dividend on ordinary shares, 5 per cent. for half year ...	15,537	14,987	13,819
Reserve for renewals of permanent way	7,000	18,000	18,000
Reserve and renewals fund ...	3,000	5,000	5,000
Balance to next account	9,958	11,366	13,045
	88,040	98,047	95,845

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track).	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Other.	Total.
				Mls. Chs.											
Aberdeen	*May 31, 1915	Dec., 1899	E.	27 56	415,000	366,332	48,668	366,332	13,225	184,118	234,194	189,803	86,614	1,388	88.002
Accrington	Mar. 31, 1914	Aug., 1907	,,	10 53	181,925	133,875	48,050	134,734	12,636	113,870	20,864	16,581	29,843	350	30,193
Ashton-u-Lyne	Mar. 25, 1914	Aug., 1902	,,	8 15	130,070	109,814	20,256	109,814	13,412	73,958	32,270	2,950	23,341	677	24,019
Ayr	*May 15, 1915	Sept., 1901	,,	9 30	128,000	98,630	29,369	100,705	10,742	78,770	27,866	17,649	17,181	804	17,985
Birmingham	*Mar. 31, 1915	Jan., 1904	,,	118 71	2,858,935	2,437,104	421,831	2,472,938	20,801	1,940,158	496,946	176,726	640,091	6,923	647,014
Blackburn	*Mar. 25, 1915	Mar., 1899	,,	24 63	408,174	342,474	65,700	336,258	13,566	354,600	191,985	3,718	65,158	3,144	68,302
Blackpool	*Mar. 31, 1915	June, 1899	,,	(p)21 51	460,473	316,005	144,468	316,005	14,604	316,005	138,577	19,698	75,344	761	76,105
Bolton	*Mar. 31, 1915	Dec., 1899	,,	47 69	551,092	551,092	Nil	570,981	11,930	348,111	202,980	43,059	140,182	1,228	141,410
Bradford	*Mar. 31, 1915	July, 1898	,,	(h)118 9	1,280,788	1,043,788	237,000	1,043,054	8,831	634,618	439,321	75,208	309,320	20,568	329,888
Brighton	*Mar. 31, 1915	Nov., 1901	,,	17 15	378,093	279,978	98,115	280,392	16,314	211,268	69,124	7,562	54,413	2,113	56,526
Burnley	*Mar. 31, 1915	Dec., 1901	,,	22 18	388,052	326,077	61,975	232,580	10,465	170,852	72,664	29,550	77,161	1,306	78,467
Burton-on-Trent	*Mar. 31, 1915	Aug., 1903	,,	10 50	108,632	104,562	4,070	106,275	10,121	47,788	56,784	10,134	15,223	1,510	16,733
Bury	*Mar. 31, 1915	June, 1903	,,	(b)36 10	407,800	284,745	123,055	293,237	12,826	254,832	55,416	33,960	68,740	276	69,016
Chester	*Mar. 25, 1915	April, 1903	,,	6 35	92,991	82,380	10,611	82,934	12,883	66,977	16,059	8,072	12,935	317	13,252
Chesterfield	Mar. 31, 1914	Dec., 1904	,,	5 8	98,000	73,500	24,500	69,810	13,663	57,660	13,820	6,307	13,608	465	14,073
Colchester	*Mar. 31, 1915	July, 1904	,,	7 75	70,748	69,555	1,193	69,471	8,736	48,360	22,007	Nil.	13,413	380	13,793
Croydon	*Mar. 31, 1915	(q) Sept., 1901	,,	17 50	287,689	287,689	Nil	286,765	16,271	222,223	107,039	41,643	87,833	781	88,614
Darlington	*Mar. 31, 1915	June, 1904	,,	8 71	107,500	77,889	29,611	8,748	77,870	55,236	25,881	7,369	13,451	261	13,712
Darwen	*Mar. 31, 1915	Oct., 1900	,,	7 13	93,400	86,300	7,100	87,199	12,174	51,200	33,555	9,396	14,645	988	15,633
Derby	Mar. 31. 1914	July, 1904	,,	22 20	239,980	239,980	Nil	245,332	11,026	177,676	67,656	(l)32,356	£51,126	1,048	52,174
Doncaster	Mar. 31, 1914	June, 1902	,,	12 58	...	...	...	107,921	8,481	94,700	16,581	1,442	22,890	318	23,208
Dundee	*May 15, 1915	July, 1900	,,	28 32	(f)	362,789	...	371,145	13,068	266,027	96,762	92,694	66,320	1,954	68,274
East Ham	*Mar. 31. 1915	June, 1901	,,	14 16	192,270	191,016	254	196,309	13,824	129,336	78,806	...	59,552	680	60,232
Exeter	*Mar. 31, 1915	April, 1905	,,	7 0	106,000	88,818	17,182	88,818	12,688	67,966	21,360	6,420	17,964	55	18,019
Gloucester	*Mar 31, 1915	April, 1904	,,	15 1	191,000	144,333	46,667	147,783	9,846	104,965	22,901	1,000	16,693	1,114	17,807
Halifax	*Mar. 31, 1915	June, 1898	,,	55 39	449,263	417,466	31,797	420,185	7,570	283,249	129,670	36,442	111,792	1,378	113,170
Ilford	*Mar. 31, 1915	Mar., 1903	,,	12 49	152,883	152,883	Nil	149,574	11,859	102,839	50,043	3,239	31,539	442	31,981
Ilkeston	Mar. 31, 1914	May, 1903	,,	3 56	64,214	47,000	17,214	47,833	13,436	31,462	16,422	...	6,915	171	7,086
Ipswich	*Mar. 31, 1915	Nov., 1903	,,	14 70	116,471	114,300	2,171	115,676	7,776	94,894	115,549	15,940	22,796	493	23,289
Keighley	Mar. 31, 1913	Oct., 1904	,,	6 9	50,934	47,328	3,606	47,328	7,745	32,468	16,961	942	8,845	313	9,158
Kilmarnock	*May 15, 1915	Dec., 1904	,,	5 47	65,000	52,795	12,205	52,801	9,450	46,450	10,078	6,618	8,416	201	8,617
Kirkcaldy	*May 15, 1915	Feb., 1903	,,	8 65	213,000	97,868	115,132	97,868	11,105	76,466	21,402	5,223	16,564	412	16,976
Lancaster	*Mar. 31, 1915	Jan., 1903	,,	4 65	...	45,700	...	43,711	9,083	28,750	17,669	3,342	5,534	159	5,693
Leith	*May 15, 1915	Aug., 1905	,,	17 73	275,000	238,000	37,000	237,983	13,286	171,500	66,070	6,604	36,298	1,086	37,384
Leyton	Mar. 31, 1914	Dec., 1906	,,	18 8	324,201	324,145	56	295,376	16,319	240,741	57,244	2,654	69,148	1,541	70,689
Lincoln	*Mar. 31, 1915	Nov., 1905	S.	2 77	98,519	44,947	53,572	44,987	15,185	40,226	12,529	(l) 692	6,435	117	6,552
Liverpool	Dec. 31, 1914	Nov., 1898	E.	124 0	2,622,786	2,057,850	564,936	2,062,391	16,741	1,168,685	1,177,949	366,545	684,026	13,050	697,076
Lowestoft	Sep. 30, 1914	July, 1903	,,	4 6	96,230	91,178	5,052	91,178	22,375	75,480	17,614	Nil	11,357	373	11,730
Maidstone	*Mar. 31, 1915	July, 1904	,,	7 3	82,932	82,932	Nil	79,398	11,282	63,598	19,334	...	10,402	602	11,004
Manchester	*Mar. 31, 1915	June, 1901	,,	203 31	2,361,038	2,207,215	153,823	2,216,009	10,895	1,648,183	548,499	438,497	887,763	14,112	901,875
Nelson	*Mar. 31, 1915	Feb., 1903	,,	3 69	38,000	37,885	115	37,885	9,808	28,086	9,799	...	9,300	52	9,352
Newport (Mon.)	*Mar. 31, 1915	April, 1903	,,	14 28	232,500	196,250	36,250	196,184	13,671	155,216	49,868	3,479	41,752	952	42,704
Nottingham	*Mar. 31, 1915	Jan., 1901	,,	44 20	...	...	...	733,674	16,586	473,999	261,364	56,626	176,289	3,026	179,315
Oldham	*Mar. 25, 1915	May, 1902	,,	28 32	506,723	446,347	60,376	453,655	15,981	303,738	166,268	2,222	111,679	2,135	113,814
				(b) 8 31											
Perth	May 15, 1914	Nov., 1913	,,	6 75	90,000	78,350	11,650	78,629	11,334	...	...	...	8,944	928	9,872
Plymouth	Mar. 31, 1914	Sept., 1899	,,	15 0	182,856	181,479	1,377	219,417	14,628	86,903	89,493	24,252	39,989	891	40,880
Pontypridd	Mar. 31, 1914	Mar., 1905	,,	8 48	...	...	...	133,143	15,482	...	...	...	23,280	320	23,600
Rawtenstall	*Mar. 31, 1915	May, 1909	,,	15 71	193,290	182,172	11,118	182,276	11,709	150,324	31,848	3,051	24,460	1,076	25,536
Rochdale	*Mar. 31, 1915	May, 1902	,,	(i) 40 2	356,991	347,782	9,209	353,200	15,407	347,782	108,034	16,000	77,660	5,742	83,402
Rotherham	*Mar. 31, 1915	Jan., 1903	,,	12 2	342,200	188,326	153,874	184,178	15,316	150,485	39,473	21,771	43,834	59	43,893
			R.T	...	...	...	...	...	...	...	...	...	...	...	...
Salford	*Mar. 31, 1915	Oct., 1901	E.	75 64	1,086,472	723,717	362,755	725,485	9,571	511,853	282,115	30,058	257,935	42	257,977
Southampton	*Mar. 31, 1915	Jan., 1900	,,	18 54	280,452	260,699	19,753	259,834	13,913	158,729	99,470	14,251	68,042	2,996	71,038
Southend-on-Sea	Mar. 31, 1913	July, 1901	,,	11 49	130,000	129,961	39	143,808	12,384	116,940	12,784	3,045	34,453	465	34,918
Southport	*Mar. 31, 1915	July, 1900	,,	(d) 10 63	292,000	197,730	94,270	196,178	8,424	67,250	57,870	442	19,970	450	20,420
South Shields	*Mar. 31, 1915	Mar., 1906	,,	10 21	251,882	184,056	67,826	181,097	17,646	155,214	37,314	30,837	39,275	570	39,845
Staly'ge, H., H., D.	*Mar. 31, 1915	May, 1904	,,	27 57	325,270	280,990	44,280	279,778	10,096	209,387	71,603	1,211	37,490	130	37,620
Stockport	Mar. 31, 1914	Aug., 1901	,,	27 5	318,847	234,500	84,347	251,514	9,294	158,391	76,109	37,179	66,715	1,322	68,037
Sunderland	*Mar. 31, 1915	Aug., 1900	,,	20 28	308,699	303,211	5,488	306,766	15,074	161,996	132,265	45,044	75,229	386	75,615
Swindon	Mar. 31, 1914	Sept., 1904	,,	4 42	...	...	...	44,216	9,771	33,861	11,738	7,237	8,602	309	8,911
Wallasey	*Mar. 31, 1915	Mar., 1902	,,	19 77	208,867	195,290	13,577	222,027	11,122	159,306	72,879	10,612	63,690	815	64,505
Walsall	Dec. 31, 1914	Dec., 1902	,,	19 44	188,145	188,100	45	182,926	9,357	154,044	63,649	34,960	33,311	778	34,089
Walthamstow	*Mar. 31, 1915	June, 1905	,,	13 30	198,000	194,000	4,000	190,477	14,251	168,248	25,249	...	41,346	443	41,789
Warrington	*Mar. 31, 1915	April, 1902	,,	9 52	103,674	102,896	778	102,128	10,583	67,028	35,869	7,977	22,631	261	22,892
West Ham	*Mar. 31, 1915	Feb., 1904	,,	30 4	578,478	551,588	26,890	556,878	18,532	469,051	123,888	26,236	147,703	4,509	152,212
West Hartlepool	*Mar. 31, 1915	Feb., 1904	,,	8 63	85,494	80,330	5,164	81,731	9,301	76,501	3,682	4,614	19,011	494	19,505
Wigan	*Mar. 31, 1915	April, 1901	,,	30 73	502,513	491,007	11,506	481,577	15,579	382,490	157,287	5,034	75,270	2,107	77,377
Wolverhampton	*Mar. 31, 1915	April, 1902	S.	21 40	279,733	268,185	11,548	292,361	13,596	209,497	71,812	53,987	54,593	730	55,323
Yarmouth (Gt.)	*Mar. 31, 1915	June, 1902	E.	14 58	149,600	124,750	24,850	126,453	8,588	115,700	29,148	9,613	21,872	494	22,366
York	*Mar. 31, 1915	Jan., 1910	,,	12 20	157,150	...	...	163,884	...	151,039	8,596	6,456	29,589	538	30,127

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	*Mar. 31, 1915	Nov., 1905	E.	98 54	1,528,146	1,381,200	136,946	1,455,506	14,702	1,343,000	257,730	96,622	266,249	3,988	270,237
Bexley	Mar. 31, 1914	Oct., 1903	,,	6 42	100,798	98,812	1,986	98,408	15,376	75,408	23,403	942	14,698	1,649	16,346
Birkenhead	*Mar. 31, 1915	Feb., 1901	,,	24 7	378,973	373,290	5,683	373,545	15,548	228,391	143,241	23,062	65,100	685	65,785
Bournemouth	*Mar. 31, 1915	July, 1902	,,	(e) 32 67	...	...	...	467,073	18,379	291,667	168,818	17,769	101,882	464	102,346
Cardiff	*Mar. 31, 1915	May, 1902	,,	31 66	832,356	787,292	45,064	811,043	25,484	485,049	302,242	98,778	139,256	36,785	176,041
Coventry	*Mar. 31. 1915	Jan., 1912	,,	15 61	251,014	238,355	12,659	238,803	15,151	229,235	14,363	4,095	44,633	771	45,404
Glasgow	*May 31, 1915	Oct., 1898	,,	198 10	4,564,266	3,694,143	870,123	3,751,708	19,127	2,411,868	1,282,275	2,326,543	1,070,694	6,184	1,076,878
				(b) 2 53											
Huddersfield	*Mar. 31, 1915	Feb., 1901	,,	56 4	772,662	467,142	305,520	477,919	8,526	281,927	194,599	7,522	124,200	2,859	127,059
Hull	*Mar. 31, 1915	July, 1899	,,	33 12	662,074	594,626	67,448	596,092	17,982	579,628	183,392	147,663	161,750	1,280	163,030
Leeds	*Mar. 31, 1915	Aug., 1897	,,	115 71	1,907,865	1,814,758	93,107	1,678,844	14,487	1,400,687	590,421	4,961	429,902	4,038	433,940
Leicester	Dec. 31, 1914	May, 1904	,,	37 0	1,006,946	818,073	138,290	828,953	22,404	674,936	147,944	91,843	149,664	20,571	170,235
London	*Mar. 31, 1915	...	H.	9 67									10,261	540	10,801
		May, 1903	C.E	274 35	(c)	(c)	(c)	13,744,806	...	9,836,187	3,786,403	565,095	2,323,130	65,916	2,389,046
N'castle-on-Tyne	*Mar. 31, 1915	Dec., 1901	E.	62 72	1,597,129	1,309,200	287,929	1,332,133	21,178	905,066	524,407	74,656	280,147	13,117	293,264
Northampton	*Mar. 31, 1915	July, 1904	,,	12 37	239,800	147,255	92,545	173,019	13,883	118,932	48,610	14,628	30,775	534	31,309
Portsmouth	*Mar. 31, 1915	Sep., 1901	,,	34 48	708,619	708,619	Nil	731,174	21,132	423,103	285,516	81,715	121,909	2,082	123,991
Preston	Mar. 31, 1914	June, 1904	,,	17 16	224,102	187,269	36,833	187,269	10,888	117,315	47,130	39,392	45,618	328	45,946
Reading	*Mar. 31, 1915	July, 1903	,,	13 14	235,000	234,000	1,000	237,102	17,996	155,419	75,406	19,471	35,608	1,074	36,682
Sheffield	*Mar. 25, 1915	Sep., 1899	,,	79 8	1,782,471	1,484,400	298,071	1,558,246	19,703	1,122,482	512,567	34,450	391,535	2,996	394,531
Wellington, N.Z.	Mar. 31, 1914	...	,,	31 55	496,423	496,423	...	628,151	19,821	496,423	46,836	120,191	157,096	1,161	158,257

C—Electric conduit system. E—Electric trolley system. H—Horse lines RT—Railless trolley system. S—Surface contact system.
(b) Includes leased lines. (c) Conferred by Annual Money Act, which limits amounts for each financial year. Powers not exercised are lapsed.
(d) Not including 12 miles 40 chains leased lines. (e) Includes 7 miles 34 chains leased lines. (f) Unlimited. (h) Includes 9 miles 26 chains railless trolley routes.
(i) 17 mi. 8 chs. single track leased. (l) Including Insurance. (p) Including leased lines. (q) Corporation working commenced June, 1908.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Working Expenses.					Gross Profit on Working.	Additions to Gross Profit	Deductions from Gross Profit.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	
Aberdeen	23,291	12,148	7,920	8,166	51,525	36,477	...	4,789	5,179	...	13,840	(i) 1,669	25,477	+ 11,000
Accrington	7,570	2,792	2,268	4,880	17,510	12,683	...	3,969	3,783	198	3,100	65	11,115	+ 1,568
Ashton-und'r-Lyne	5,149	1,682	3,053	3,372	13,256	10,763	...	2,590	3,760	477	800	39	7,666	+ 3,097
Ayr	4,682	(i)2,301	1,494	2,504	10,981	7,004	...	2,487	2,310	...	...	...	7,004	...
Birmingham	187,946	(i)86,491	86,067	113,375	473,879	173,135	5,558	71,965	58,402	...	...	730	131,097	+ 47,596*
Blackburn	16,859	6,197	14,451	9,421	46,928	21,374	287	(h) 4,388	15,450	251	1,572	...	21,661	...
Blackpool	17,632	(i 7,755	9,239	10,225	44,851	31,254	...	(h) 9,878	7,640	...	...	...	17,518	+ 13,736
Bolton	30,044	(g) 9,486	15,912	20,689	76,131	65,279	857	(h) 10,525	17,520	1,713	18,339	(i) 981	49,078	+ 17,058
Bradford	91,597	(i)36,890	64,670	52,938	246,095	83,793	4,525	22,087	24,164	5,422	7,832	4,203	63,708	+ 24,610
Brighton	14,152	(i) 6,759	13,690	8,384	42,985	13,541	55	7,661	5,917	...	...	...	13,578	+ 18
Burnley	21,142	(i)10,079	9,141	17,955	58,317	20,150	...	6,796	8,284	1,515	...	(f) 1,890	18,486	+ 1,664
Burton-on-Trent	5,609	(i) 1,821	2,686	3,086	13,202	3,531	24	1,266	1,451	...	...	...	2,717	+ 838
Bury	16,129	4,971	7,162	7,504	35,766	33,250	303	(h) 7,037	6,026	825	2,472	(w) 11,193	27,553	+ 6,000
Chester	3,304	(i) 1,834	1,318	2,256	8,712	4,540	130	(h) 2,748	1,018	...	904	...	4,670	...
Chesterfield	3,214	1,368	2,936	2,192	9,710	4,363	269	2,275	1,900	...	...	...	4,175	+ 457
Colchester	3,045	1,372	2,370	2,783	9,570	4,223	28	(h) 1,986	2,496	...	...	(i) 172	4,654	− 403
Croydon	31,319	(i) 9,151	14,128	17,684	72,282	16,332	749	7,889	7,415	1,587	...	...	16,891	+ 190
Darlington	4,273	896	1,895	2,103	9,167	4,545	160	1,926	2,006	101	1,202	...	5,235	− 530
Darwen	4,064	1,146	3,260	2,653	11,123	4,510	222	2,221	2,190	...	1,050	...	5,461	− 729
Derby	E 17,320 H 540	2,906 ...	5,499 81	8,610 ...	34,335 621	17,839 def. 173	239	6,236	3,464	...	5,536	(l) 185	15,421	+ 2,657
Doncaster	4,969	1,342	6,550	4,166	17,027	6,181	16	2,935	1,840	138	572	58	5,543	+ 654
Dundee	17,829	(i)7,398	7,445	10,686	43,358	24,916	...	8,990	6,700	323	7,842	...	23,855	+ 1,061
East Ham	19,381	6,796	14,558	10,884	51,619	8,613	...	5,279	6,858	...	...	...	12,137	− 3,524
Exeter	4,793	1,535	1,715	3,556	11,599	6,420	...	(h) 2,241	1,950	120	...	...	4,311	+ 2,109
Gloucester	7,250	1,643	2,975	1,836	13,704	4,103	...	(h) 5,362	1,881	370	...	...	7,613	− 3,510
Halifax	30,501	7,877	13,529	21,597	73,504	39,321	345	10,424	12,106	...	(y) 925	(i) 2,632	23,455	+ 16,211
Ilford	10,444	3,518	4,171	5,387	23,520	8,461	557	3,786	5,252	...	...	...	9,038	− 20
Ilkeston	2,262	789	1,378	1,460	5,889	1,197	160	1,450	1,532	90	...	96	3,168	− 1,811
Ipswich	8,801	1,962	5,033	3,494	19,290	3,999	(u) 4,877	(h) 3,660	2,207	...	3,421	(i) 237	9,525	− 649
Keighley	2,692	768	899	1,612	5,971	3,187	179	1,116	1,881	...	...	(n) 369	3,366	...
Kilmarnock	2,995	(i)801	1,434	1,636	6,866	1,751	5	(h) 1,863	1,110	...	1,160	...	4,133	− 2,377
Kirkcaldy	4,811	1,416	2,312	2,912	11,451	5,525	68	2,604	2,411	...	409	136	5,560	+ 33
Lancaster	2,207	(i)617	879	1,615	5,318	375	52	942	1,250	...	...	...	2,192	− 1,765
Leith	9,979	3,455	5,148	4,215	22,797	14,587	2,264	(h) 6,029	7,850	...	3,252	150	17,281	− 430
Leyton	(p)22,360	8,611	13,711	12,923	57,605	13,084	133	10,007	8,461	...	...	202	18,670	− 5,453
Lincoln	1,446	656	967	872	3,941	2,611	47	1,529	1,071	...	...	(i) 6	2,606	+ 52
Liverpool	192,352	69,830	83,100	123,527	468,809	228,267	25,231	50,082	63,726	...	(d)34,821	(e) 4,869	153,498	+ 100,000
Lowestoft	3,405	655	1,552	2,323	7,935	3,795	..	2,441	2,251	...	...	...	4,692	− 897
Maidstone	2,584	1,152	2,052	1,771	7,559	3,445	56	2,473	1,976	...	...	...	4,449	− 948
Manchester	273,002	(i)117,573	85,280	128,350	604,205	237,670	14,615	(h)58,243	57,599	13,790	48,584	(c)34,069	212,285	+ 100,000
Nelson	2,390	798	1,717	1,982	6,887	2,465	...	958	1,059	...	...	314	2,331	+ 134
Newport (Mon.)	10,429	4,234	9,655	6,638	30,956	11,748	857	5,694	4,357	...	1,886	(i) 668	12,605	...
Nottingham	48,272	14,674	17,408	30,692	111,046	68,269	...	16,444	21,121	...	...	(i) 2,040	39,605	+ 28,664
Oldham	27,159	10,158	28,025	19,742	85,084	28,730	1,639	16,158	11,734	2,347	...	(g) 5,799	36,038	− 5,669
Perth	...	...	...	...	6,002	3,870	...	...	...	...	...	...	...	...
Plymouth	8,430	3,896	4,514	8,026	24,866	16,014	1,257	4,282	3,141	690	5,121	...	13,234	+ 4,037
Pontypridd	...	...	...	...	16,111	...	...	...	...	...	...	...	...	...
Rawtenstall	6,126	2,446	3,187	4,273	16,032	9,504	85	5,483	6,493	...	...	...	11,976	− 2,387
Rochdale	19,308	5,063	10,984	11,537	46,892	36,510	1,636	11,478	9,594	2,038	...	(i) (x) 10,752	33,862	+ 4,284
Rotherham	E 11,039 RT ...	4,071 ...	5,864 ...	8,718 ...	29,692 ...	14,201 ...	195 ...	5,349 ...	3,465 ...	... ...	4,082 ...	... ...	12,896 ...	+ 1,500 ...
Salford	75,579	(i)24,562	27,778	48,819	176,748	81,229	4,477	15,791	668	4,112	492	(k)29,378	51,441	+ 34,265
Southampton	21,466	(i) 6,862	9,433	12,545	50,306	20,732	(t)6,757	7,564	7,557	952	5,000	...	21,073	+ 6,416
Southend-on-Sea	8,046	2,260	3,534	6,187	20,027	14,891	4,228	(h) 3,834	1,753	...	4,017	...	9,605	+ 9,514
Southport	4,922	(i)2,406	2,765	3,015	13,108	7,312	6,249	6,549	5,018	...	2,120	...	13,687	− 126
South Shields	9,249	(i)5,225	4,156	6,880	25,510	14,335	140	5,230	3,651	...	...	...	8,881	+ 8,594
Staly'dge, H., M., D.	12,818	(i) 5,022	7,448	5,761	32,049	5,571	...	7,485	7,786	...	400	397	16,068	− 10,497
Stockport	14,828	4,583	10,045	5,964	35,420	32,617	1,170	5,432	8,909	1,163	2,369	(j) 3,414	21,287	+ 12,500
Sunderland	19,807	5,608	4,867	11,267	41,549	34,066	265	(h) 6,464	10,374	1,218	10,875	400	29,331	+ 5,000
Swindon	2,854	828	1,534	1,850	7,066	1,845	45	1,215	1,422	...	...	...	2,637	− 747
Wallasey	18,736	(i) 6,704	6,213	10,801	42,454	22,051	1,249	5,520	5,072	...	...	634	11,226	+ 12,074
Walsall	8,510	3,326	4,315	5,670	21,821	12,268	1,339	4,962	3,975	551	640	...	10,128	+ 3,479
Walthamstow	14,417	2,972	8,845	8,546	34,780	7,009	30	(h) 6,427	3,468	...	...	(i) 712	10,607	− 3,568
Warrington	6,135	(i)2,556	2,996	3,323	15,010	7,882	481	2,418	3,447	...	...	...	5,865	+ 2,498
West Ham	52,659	†14,531	33,326	19,420	119,936	32,276	243	18,875	12,679	...	692	...	32,246	+ 273
West Hartlepool	4,791	1,586	2,956	2,241	11,574	7,931	3	2,569	1,847	...	..	(f) 500	4,916	+ 3,018
Wigan	17,340	5,252	12,768	10,817	46,177	31,200	331	(h) 13,866	13,101	...	...	3,662	30,629	+ 902
Wolverhampton	13,031	(i) 6,239	8,594	7,202	35,066	20,257	(x) 2,535	7,760	5,669	203	5,416	...	19,048	+ 3,744
Yarmouth (Gt.)	7,397	(i) 1,989	2,833	4,441	16,660	5,706	40	(h) 4,158	2,883	...	...	...	7,041	− 1,295
York	9,958	(i)2,908	2,785	6,004	21,655	8,472	...	(h) 5,176	2,084	...	...	...	7,260	+ 1,212

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	75,752	17,245	35,294	28,622	156,913	113,325	...	48,342	31,277	1,478	17,879	2,164	101,140	+ 12,185
Bexley	3,282	1,382	*3,554	828	(s) 11,630	4,716	...	2,794	2,509	...	324	...	5,627	− 911
Birkenhead	15,923	(i)5,621	12,124	5,839	39,507	26,278	...	(h)11,340	9,760	527	3,500	151	25,278	+ 1,000
Bournemouth	22,933	7,998	9,095	15,040	55,066	47,280	955	(h)10,587	16,535	...	...	i)12,166	39,288	+ 8,947
Cardiff	43,914	11,332	26,879	26,593	108,718	67,323	1,123	23,925	22,645	2,272	6,947	2,655	58,444	+ 10,002
Coventry	13,626	4,333	9,005	3,564	30,528	14,876	137	8,521	5,755	...	...	(i)634	14,910	+ 103
Glasgow	345,625	(i)193,837	144,530	51,995	735,987	340,891	65,826	78,797	105,492	22,790	172,310	14,377	393,766	+ 12,951
Huddersfield	33,571	(i)7,911	20,449	12,047	73,978	53,081	...	h)12,536	13,061	2,274	15,575	1,235	44,681	+ 8,400
Hull	(i)58,137	12,634	31,909	11,622	114,302	48,728	...	16,578	13,883	576	3,117	...	34,154	+ 14,574
Leeds	115,601	40,347	43,609	28,577	228,134	205,805	7,837	47,174	57,773	7,356	11,928	(i)7,844	132,075	+ 81,567
Leicester	59,052	11,397	22,836	25,322	118,607	51,628	1,660	24,218	13,764	2,801	10,741	1,284	52,808	+ 480
London	H. 4,737 E.793,481	1,859 (r) 276,574	3,878 364,064	(m) 5,854 250,124	16,328 1,684,243	def. 5,527 704,803	... 47,425	330,301	405,605	32,102	1,541	(l)15,851	785,400	− 33,172
N'castle-on-Tyne	79,328	25,580	31,120	24,430	160,458	132,806	3,197	(h)29,574	43,356	5,411	68	(i)13,837	92,246	+ 43,757
Northampton	8,428	3,187	3,103	6,136	20,854	10,455	473	(h) 3,900	4,624	441	90	(ib)1,221	10,276	+ 652
Portsmouth	31,414	(i)13,293	8,371	5,580	58,658	65,333	(a)11,483	21,643	18,455	1,941	11,677	532	54,248	+ 22,568
Preston	12,350	4,989	9,252	2,995	29,586	16,360	...	3,625	5,038	...	...	1,356	10,019	+ 6,341
Reading	8,324	(i)4,356	4,313	3,643	20,654	16,028	11	6,709	5,062	263	...	...	12,034	+ 4,005
Sheffield	120,296	(i)31,784	45,385	49,365	246,830	147,701	2,056	31,747	42,504	5,567	30,017	8,014	117,849	+ 31,908
Wellington, N.Z.	57,973	7,775	21,918	17,947	105,613	52,644	2,091	19,865	4,757	...	14,682	...	39,304	+ 15,431

(a) Includes £10,703 balance forward from previous year. (b) Includes £152 loss on omnibus account less profit on parcel service. (c) Includes £1,611 insurance fund. (d) Includes reserve. (e) Includes rents for leased lines. (f) Rent of leased lines. (g) Rent of lines and deficit on motor omnibus account. (h) Including income tax. (i) Includes Army Service Allowance. (j) Includes £692 deficit on railless traction. (k) Includes rents of lines. (l) Including loss on horse traction. (m) Horsing expenses. (n) Transferred to motor omnibus capital account. (o) Includes £1,337 through-running contributions. (p) Includes £407 horse account. (q) Includes National Insurance. (r) Including special charges. (s) Includes £2,584 through-running contributions to L.C.C. (t) Includes balance forward from previous year. (u) From borough fund. (w) Amount apportioned to leased lines. (x) Includes £1,554 profit on motor char-a-banc. (y) Parliamentary Expenses. (z) Includes £6,519 rent of leased lines. * Includes £1,913 spent on renewals. † Under a resolution of the Council, the allowances to employees serving with the Forces, amounting to £6,031, are defrayed out of rates and therefore not included in these accounts. ‡ £2,950 profit from 3 months' working.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus.			Receipts per Car Mile.		Operating Expenses per Car Mile.					Percentage of Operating Expenses to Total Revenue.	Average Operating Expenses per Car Mile (excludi'g Power Cost).	Board of Trade Units.		
	Carried Forward.	Reserve.	Contribution to Rates or Municip'l Funds.	Average Total per Car Mile. d.	Average Traffic per Car Mile. d.	Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. (Price paid) d.	Total. d.	%	d.	Units.	Cost per Unit. d.	Units used per car mile.
Aberdeen ...	...	7,590	3,410	11·06	10·89	2·93	1·55	·99	1·03	6·48	58·54	5·45	2,317,204	·846	1·027
Accrington ...	...	...	1,568	12·64	12·49	3·17	1·18	·94	2·04	7·33	57·99	5·29	949,054	1·23	1·65
Ashton-u-Lyne	47	...	3,050	12·4197	12·0692	2·6622	·8695	1·5788	1·7434	6·8539	55·19	5·1105	640,413	1·25	1·38
Ayr...	...	...	...	9·61	9·18	2·50	1·25	·79	1·33	5·87	63	4·47	442,969	1·28	·98
Birmingham ...	30,000	17,596	...	10·910	10·793	3·169	1·459	1·451	1·912	7·991	73	6.079	24,186,574	1·125	1·7
Blackburn ...	...	...	...	13·81	13·71	3·40	1·25	2·92	1·91	9·48	68·70	7·57	1,739,274	1·3	1·84
Blackpool ...	...	1,736	12,000	16·82	16·65	3·90	1·71	2·04	2·26	9·91	58·93	7·65	1,552,635	1·58	1·43
Bolton	58	...	17,000	11·758	11·656	2·498	·788	1·323	1·721	6·330	53·836	4·610	4,514,010	1·1	1·56
Bradford	...	14,610	10,000	12·425	11·816	3·457	1·041	2·450	2·027	8·975	74·60	6·948	12,272,121	1	1·926
Brighton	18	...	...	12·240	11·782	3·064	1·464	2·964	1·816	9·308	72·79	7·10	1,676,770	1·2	1·51
Burnley	...	...	1,664	11·450	11·259	3·085	1·108	1·334	2·620	8·147	71·16	5·53	3,621,567	1·15	2·20
Burton-on-Trent	838	...	...	9·13	8·30	3·06	·99	1·47	1·68	7·20	78·8	5·28	530,080	1·39	1·04
Bury	...	(k)1,000	5,000	10·26	10·22	2·399	·776	1·253	1·268	5·696	51·82	4·428	2,045,692	1·25	1·26
Chester	...	...	...	9·16	8·94	2·28	1·27	·92	1·56	6·03	66	4·39	414,118	1·33	1·19
Chesterfield ...	...	457	...	11·1	10·8	2·54	1·08	2·31	1·73	7·66	68·9	5·93	420,824	1·26	1·38
Colchester ...	...	...	...	9·942	9·668	2·194	·989	1·709	2·006	6·898	69·24	4·892	445,214	1·5	1·34
Croydon	...	190	...	7·593	7·526	2·683	·784	1·211	1·516	6·194	78·68	4·493	3,000,308	1·416	1·071
Darlington ...	...	...	...	8·487	8·326	2·645	·554	1·172	1·304	5·675	66·85	4·371	504,546	1	1·301
Darwen	...	...	...	14·02	13·13	3·65	1·03	2·93	2·38	9·99	71·15	7·61	485,033	1·312	1·812
Derby	(n) 75	...	...	E 10·358	10·150	3·438	·577	1·092	1·709	6·816	65·8	5·107	1,425,112	1·45	1·179
				H. 6·077	8·821	7·325	...	1·099	...	8·424	138·6	...	...	...	...
Doncaster ...	...	654	...	10·52	10·37	2·24	·61	2·97	1·90	7·72	73·1	5·82	799,965	1·25	1·51
Dundee	...	61	1,000	11·802	11·465	3·082	1·278	1·288	1·847	7·495	63·5	5·648	2,564,659	1	1·847
East Ham ...	..	...	...	9·05	8·95	2·91	1·02	2·19	1·63	7·75	85·70	6·12	2,461,677	1·062	1·84
Exeter	...	2,109	...	9·629	9·60	2·560	·821	·917	1·900	6·198	64·37	4·298	615,956	1·375	1·38
Gloucester ...	...	...	...	6·84	6·41	2·78	·63	1·14	·71	5·26	77	4·55	470,336	1	·70
Halifax	...	(r) 7,483	(s)6,171	11·657	11·514	3·141	·812	1·393	2·225	7·571	65	5·35	4,607,293	1·125	1·98
Ilford	...	...	...	8·127	8·006	2·846	·729	1·164	1·109	5·848	73·6	4·60	1,131,616	1·125	1·172
Ilkeston	...	...	...	7·04	6·87	2·3	·8	1·3	1·4	5·8	83	4·4	372,200	1	1·84
Ipswich	...	...	...	8·705	8·52	3·290	·732	1·882	1·306	7·210	82·83	5·904	670,809	1·25	1·046
Keighley	...	...	...	9·064	8·754	2·664	·761	·890	1·595	5·910	65	4·315	254,636	1·5	1·05
Kilmarnock ...	...	...	...	7·413	7·240	2·569	·695	1·235	1·408	5·907	79·6	4·499	314,191	1·25	1·13
Kirkcaldy ...	33	...	...	9·085	8·864	2·574	·758	1·238	1·558	6·128	67·4	4·57	698,804	1	1·558
Lancaster ...	...	...	...	8·10	7·80	3·11	·87	1·242	2·28	7·50	92·57	5·22	227,984	1·7	1·34
Leith	...	...	...	9·26	8·99	4 2·47	·86	1·27	1·03	5·63	60·98	4·60	984,428	1·027	1·02
Leyton	...	...	...	9·355	9·151	(c) 2·959	1·140	1·815	1·710	7·624	81·338	5·914	3,043,900	1·019	1·678
Lincoln	52	...	...	10·59	10·40	2·34	1·06	1·56	1·41	6·37	60·2	4·96	173,895	1·25	1·128
Liverpool ...	...	...	100,000	12·25	12·02	3·380	1·227	1·460	2·171	8·238	65·6	6·067	26,007,694	1·14	1·9
Lowestoft ...	...	...	...	9·1	8·8	2·60	·5	1·2	1·8	6·1	67·64	4·3	318,601	1·75	1·03
Maidstone ...	...	...	...	8·77	8·295	2·04	·90	1·63	1·40	5·97	71·96	4·57	366,191	1·125	1·217
Manchester ...	...	...	100,000	11·300	11·123	3·420	1·473	1·069	1·608	7·570	63·47	5·962	29,922,197	1·029	1·562
Nelson	134	...	...	11·66	11·60	2·98	·99	2·14	2·48	8·59	74	6·11	241,886	2	1·26
Newport (Mon.)...	...	...	...	10·622	10·385	2·594	1·053	2·402	1·651	7·700	72·49	6·049	1,178,500	1·30	1·22
Nottingham ...	...	6,164	22,500	11·35	11·16	3·06	·93	1·10	1·94	7·03	62·78	5·09	5,806,688	1·25	1·53
Oldham	...	...	...	13·351	13·101	3·186	1·191	3·288	2·316	9·981	74·75	7·665	3,158,752	1·5	1·544
Perth	...	...	...	9·39	8·51	3·08	·40	·77	1·46	5·71	60·79	4·25	295,846	1·25	1·17
Plymouth ...	...	...	4,037	12·066	11·450	2·42	1·11	1·29	2·298	7·12	60·83	4·82	1,159,069	1·66	1·38
Pontypridd ...	...	...	...	13·29	13·11	2·82	3·67	·74	1·84	9·07	68·26	7·23	627,593	1·26	1·47
Rawtenstall ...	...	...	...	10·11	9·699	2·40	·99	1·27	1·69	6·35	62·87	4·66	833,714	1·23	1·37
Rochdale... ...	4,284	...	...	11·292	11·134	2·611	·682	1·524	1·654	6·471	56·2	4·817	2,836,062	1·006	1·694
Rotherham ...	E....	...	1,500	12·37	12·37	3·11	1·15	1·65	2·46	8·37	67·65	5·91	1,669,691	1·25	1·96
	R.T....	...	...	...	...	...	...	..	...	...	...	...	...	...	...
Salford	...	12,265	22,000	10·623	10·622	3·112	1·011	1·144	2·050	7·317	66	4·972	9,602,534	1·22	1·667
Southampton ...	1,282	...	5,134	...	...	...	...	...	...	...	...	...	...	...	...
Southend-on-Sea	2,514	1,000	6,000	13·14	12·97	3·03	·85	1·33	2·33	7·84	57·35	5·21	848,538	1·75	1·33
Southport ...	...	...	...	10·303	10·227	2·483	1·213	1·395	1·521	6·612	63	4·958	465,241	1·5	·977
South Shields ...	...	3,194	2,400	10·308	10·160	2·392	1·352	1·075	1·780	6·599	62·4	4·652	1,200,086	1·353	1·293
Stalybridge, &c.	...	...	...	8·084	8·056	2·755	1·079	1·600	1·453	6·887	83·15	5·269	1,803,063	·9	1·614
Stockport ...	...	250	12,250	10·958	10·745	2·388	·738	1·618	·961	5·705	47·94	4·744	...	...	...
Sunderland ...	...	...	5,000	12·210	12·148	3·198	·905	·786	1·820	6·709	54·75	4·8	1,802,694	1·5	1·21
Swindon	...	...	...	9·62	9·24	3·06	·89	1·65	1·99	7·59	79·29	5·60	277,568	1·6	1·24
Wallasey ...	...	4,500	(a) 8.000	12·048	11·896	3·499	1·252	1·160	2·018	7·929	65·8	5·911	1,851,649	1·4	1·44
Walsall	2,479	...	1,000	11·353	11·094	2·834	1·108	1·437	1·888	7·267	64·012	5·379	858 649	1·68	1·164
Walthamstow ...	...	...	...	8·75	8·66	3·02	·62	1·85	1·79	7·28	83 23	5·49	1,491,700	1·375	1·3
Warrington ...	2,498	...	...	12·334	12·193	3·305	1·377	1·615	1·790	8·087	64·22	6·208	531,700	1·5	1·193
West Ham ...	...	273	...	9·713	9·427	3·359	1·314	2·127	1·239	8·039	78	6·41	6,306,731	·75	1·66
West Hartlepool	...	3,018	...	9·77	9·52	2·39	·79	1·49	1·13	5·80	59	4·67	680,972	·78	1·42
Wigan	902	...	...	12·415	12·077	2·791	·866	2·052	1·736	7·445	59·70	5·80	2,186,073	1·187	1·461
Wolverhampton	...	...	3,744	11·239	11·091	2·648	1·267	1·746	1·463	7·124	62·5	5·661	1,712,796	1	1·45
Yarmouth (Gt.)...	...	...	...	7·927	7·752	2·618	·704	1·008	1·575	5·905	76·17	4·30	708,756	1·50	1·046
York	...	1,212	...	9·45	9.31	3·11	·92	·88	1·89	6·80	71·87	4·91	...	...	...

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

									*					Works Cost.	
Belfast	...	...	12,185	10·08	9 93	2·83	·64	1·32	1·07	5 86	58·07	4·79	10,439,797	·658	1·39
Bexley	...	...	...	11·13	12·3	2·53	·85	2·82	·68	6·88	71·1	6·20	487,110	·827	1·66
Birkenhead ...	...	1,000	...	13·058	12·922	3·161	1·115	2·406	1·160	7·842	59·99	6·67	2,341,009	·60	1·936
Bournemouth ..	...	8,947	...	13·52	13·46	3·03	1·05	1·20	(b) 1·99	7·27	53·80	5·28	3.072,169	·65	1·69
Cardiff	10,002	...	...	12·354	12·14	3·843	·992	1·358	·835	7·028	59·1	6·193	4,936,582	·475	1·80
Coventry ...	103	...	...	9·902	9·734	2·971	·945	1·964	·778	6·658	67·2	5·88	1,651,950	·502	1·47
Glasgow	...	...	12,951	10·674	10·612	3·426	1·922	1·432	·515	7·295	59·87	6·266	33,848,947	·366	1·40
Huddersfield ...	8,400	...	...	11·05	10·79	2·92	·70	1·78	1·04	6·44	58·22	5·40	5,398,258	·49	1·93
Hull	...	4,574	10,000	8·61	8·53	2·87	·66	1·68	·61	5·82	67·58	5·26	6,352,263	·44	1·40
Leeds	...	...	81.567	10·936	10·834	2·914	1·016	1·099	·720	5·749	52·57	5·029	18,862,847	·668	1·918
Leicester... ...	...	...	480	9·875	8·682	3·425	·661	1·325	1·469	6·880	69	5·411	7,540,856	·420	1·82
London	...	...	...	E. 9·77	9·50	3·24	1·14	1·49	1·02	6·89	68·73	5·69	152,666,477	·615	2·60
				H. 9·51	9·03	4·17	1·64	3·41	5·15	14·37	151·17	14·37	...	...	...
N'castle-on-Tyne	...	25,757	18,000	12·187	11·642	3·297	1·063	1·293	1·015	6·668	53·02	5·653	11,259,266	·382	1·968
Northampton ...	...	652	...	10·89	10·70	2·94	1·10	1·08	2·13	7·25	68	5·12	1,189,423	1·24	1·57
Portsmouth ...	6,568	(i) 6,000	10,000	12·201	11·997	3·092	1·308	·824	·549	5·773	45·88	5·050	3,272,089	·483	1·139
Preston	...	5,041	1,300	10·75	10·54	2·890	1·168	2·164	·700	6·922	64·40	6·222	1,765,250	·407	1·49
Reading	...	1,005	3,000	9·520	9·242	2·165	1·131	1·119	·945	5·360	54·55	4·248	1,180,507	·740	1·15
Sheffield	...	9,032	22.876	10·747	10·666	3·277	·866	1·236	1·345	6·724	61·116	5·379	18,329,775	646	1·979
Wellington, N.Z.	15,431	...	...	16·309	16·189	5·974	·801	2·259	1·850	10·884	65·86	9·034	4,769,149	·906	2·05

* The figures given under "Power" in Table II. include actual works costs only. H—Horse lines. E—Electric trolley system. (a)—Debit balance forward £126.
(b) Including current supplied by Bournemouth and Poole Supply Company. (c) Horse account ·054d. (f) Insurance fund. (i) Including Insurance. (k) Insurance.
(n) Remainder expended in paying capital expenditure not borrowed. (r) Renewals Fund. (s) Military Allowances, &c., £2,557. (t) Amounts for 15 months.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Population Served.	Traffic Records. Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Traffic Revenue per Mile of Single Track. £	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Average Speed per Hour. Miles.	Average Total Car Hours per Day.	Average Number of Cars in Use Daily.	Number of Cars in Stock.
Aberdeen ...	165,000	1,909,009	24,048,816	12·59	·86	145·8	90	3,121	10/6	·514	1·861	·87	7·6	812	63	83
Accrington...	45,525	573,536	4,998,979	8·72	1·377	109·8	105	3,033	13/1	·84	1·07	·929	7·5	250	18	27
Ashton-u-L.	50,000	464,160	5,053,701	10·888	·648	173·09	106	2,851	9/4	·368	1·223	·61	8	190	12	25
Ayr	33,000	448,725	4,019,771	8·96	1·02	122	103	1,832	10/5	·65	1·25	·75	8	168	12	22
Birmingham	870,000	14,232,902	149,443,199	10·5	1·03	171·8	86·63	5,384	14·9	·76	...	...	...	...	...	...
Blackburn ...	200,000	1,121,769	12,223,569	10·89	1·28	61·12	105	2,528	6/6	·902	1·26	·76	7·60	434	31	61
Blackpool ...	67,500	1,085,663	13,624,514	12·55	1·32	201·8	103	4,370	22/4	·79	...	...	8	...	29	84
Bolton ...	221,000	2,886,180	31,370,166	10·86	1·066	141·49	124·07	2,920	12/8	·582	1·553	·633	7·25	980	70	112
Bradford ...	370,000	6,194,057	70,077,271	11·31	1·059	189	113	2,807	16/6	·84	1·66	·830	7·3	2,402·5	155	252
Brighton ...	133,936	1,108,362	11,837,828	11	1·10	88·38	76·08	3,165	8/1½	·83	1·27	·787	6·41	512	32	53
Burnley ...	175,000	1,644,712	15,867,699	9·65	1·16	96	120	3,544	8/10	·88	1·25	·83	7	798	42	67
Burton ...	48,000	440,021	3,311,355	7·53	1·06	69	...	1,790	6/4	·95	1·305	·88	7·5	...	...	20
Bury	128,202	1,613,357	15,513,264	9	1·07	121·47	99·73	1,904	10·9	·554	1·30	·77	8·54	...	...	54
Chester ...	39,028	347,315	3,275,944	9·43	·95	83·9	95	2,009	6/5	·64	1·27	·8	7	144·57	10·04	18
Chesterfield	50,000	304,376	2,950,774	9·7	1·1	76	122	2,668	5/5	·78	1·38	·75	7·33	126	7	17
Colchester ...	65,000	332,963	2,434,786	7·31	1·32	37·46	86·80	1,689	4/1	·94	·85	·96	6·77	147·14	10·51	18
Croydon ...	181,956	2,803,883	19,847,402	7·08	1·062	109·08	128	4,983	9/9	·850	2·15	·50	8·23	933·60	60	75
Darlington...	62,383	387,714	4,234,783	10·9	·76	62·15	96·5	1,499	4/4	·52	1·219	·45	6·66	151·25	11	18
Darwen ...	...	267,670	2,741,987	10·24	1·28	...	...	2,045	...	·97	...	...	...	...	...	...
Derby ...	124,000	E 1,206,880 H. 17,710	12,136,148 110,231	10·039 6·224	1·011 ·935	97·88	...	2,398 ...	8/3 ...	·67 1·35	1·44 1	·75 1	6·375 ..	...	...	50 3
Doncaster ...	60,000	539,122	5,747,273	10·86	·955	95·79	93·9	1,798	7/7	·711	1·26	·76	7·5	239	18	32
Dundee ...	165,000	1,388,345	18,753,140	13·50	·851	113	...	2,345	8/-	·544	2	·80	7·3	...	...	72
East Ham ...	145,000	1,596,984	18,916,971	11·84	·75	130	...	4,192	8/2	·65	1·71	·63	...	...	..	...
Exeter ...	48,660	449,103	4,611,444	10·27	·93	95	...	2,566	7/4	·603	...	...	...	...	...	24
Gloucester ...	53,972	624,402	4,358,510	7	·92	81	90·60	1,113	6/2	·75	1·6	·68	7·08	250·8	19	30
Halifax ...	176,000	2,330,104	20,707,071	8·89	1·27	118	81·76	2,015	12/8	·852	1·553	·82	7·23	883·74	78	101
Ilford ...	88,000	945,433	9,203,077	10·48	·78	104·6	...	2,462	7/2	·613	1·843	·69	8	...	...	27
Ilkeston ...	32,000	241,548	1,746,382	7·2	·95	...	90	1,942	52/8	·8	1·50	·5	7	101	7	13
Ipswich ...	76,472	642,092	5,610,332	8·73	·975	73·4	64·4	1,532	6/-	·82	1·53	·603	5·47	322·56	20·16	36
Keighley ...	43,000	242,500	3,099,272	12·8	·68	72·06	55·35	1,447	4/1	·462	2·22	·45	6·87	126	7	12
Kilmarnock	36,000	278,987	2,311,708	8·28	·87	64·2	96·83	1,507	4/8	·712	1·13	·86	7·22	98·03	7·88	14
Kirkcaldy ...	39,600	448,469	5,492,120	12·24	·723	138	49	1,882	8/4	·5	1·823	·64	7	158	17	22
Lancaster ...	41,908	170,337	1,559,037	9·15	·852	37·20	75	1,153	2/8	·812	1·71	·5	8	84·7	6·05	12
Leith ...	110,500	968,808	10,220,069	10·55	·85	92·5	126	2,017	6/7	·53	1·32	·72	6·4	315	21	37
Leyton ...	124,735	1,813,462	17,472,882	9·64	·950	140	120	3,820	11/1	·791	1·77	·95	8·25	14·5	40·0375	60
Lincoln ...	20,000	148,440	1,713,542	11·5	·89	85·67	59·3	2,169	6/5	·552	1·75	·428	7	72	4	8
Liverpool ...	840,000	13,667,888	145,656,374	10·67	1·127	173·40	89·09	5,516	16/3	·772	2·514	·39	7·75	5,040	420	596
Lowestoft ...	35,000	307,838	2,706,348	8	1·07	77·32	70·25	2,787	6/6	·703	1·5	·7	5·75	192	12	19
Maidstone ...	25,000	300,945	2,423,514	8·053	1·03	96·94	82	1,478	8/4	·741	1	1	6·8	128	12	19
Manchester	957,500	19,155,051	202,768,420	10·6	1·06	212	93·5	4,835	18/7	·717	2·514	...	7·75	7·2	561	683
Nelson ...	45,000	192,378	2,484,775	12·92	·85	55·22	87·84	2,407	4/2	·665	1	1	5·8	108	6	11
Newport ...	90,000	964,895	9,410,109	9·75	1·09	104	...	2,909	9/3	·79	1·164	·898	...	...	...	44
Nottingham	264,000	3,789,857	41,210,964	10·87	1·02	156	95·28	3,984	13/4	·646	1·75	·443	6·92	...	109	155
Oldham ...	180,000	2,045,840	22,171,712	10·837	1·19	123·176	...	3,018	12/4	·92	1·13	·863	7	...	...	97
Perth... ...	35,900	252,216	1,844,588	7·31	1·16	51	...	1,289	5/-	·78	...	...	...	...	...	...
Plymouth ...	112,000	838,142	9,333,087	11·13	1·027	83·33	...	2,666	7/2	·639	..	...	...	...	...	42
Pontypridd...	50,000	426,228	5,577,666	13·09	1	111	...	2,707	9/4	·69	...	...	...	...	...	...
Rawtenstall	40,000	605,485	4,869,792	8·04	1·21	122	111	1,540	12/3	·79	1·121	·88	8·50	247·5	15	24
Rochdale ...	130,000	1,772,546	14,286,607	8·06	1·387	109·90	110·30	2,085	11/11	·78	1·07	·90	7·33	660	44	69
Rotherham...	64,000	E 850,548 RT ...	9,828,838	11·55	1·07	153·6	...	3,645	13/1	·72	...	...	...	...	...	...
Salford ...	350,000	5,828,238	54,343,908	9·324	1·134	155	104	3,403	14/9	·78	2·20	·46	7·916	2,065·5	153	200
Southampt'n	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Southend ...	78,000	637,366	7,581,104	11·89	1·09	97·2	87	4,708	8/10	·634	1·41	·76	6·5	357	21	31
Southport ...	31,312	478,680	4,772,478	10·033	1·004	152·41	100	1,850	12/9	·7	1·6	·7	6·65	225	15	27
So'th Shields	110,600	927,728	10,479,421	11·296	·899	91	126	3,826	7/1	·58	2·1	·38	7·71	285	20	40
Stalybridge	94,091	1,116,936	8,406,915	7·706	1·06	89·3	...	1,353	8/-	·905	1·22	·72	6·8	...	...	60
Stockport ...	120,000	1,490,116	...	...	...	...	...	2,356	11/2	...	...	...	..	...	...	...
Sunderland	170,000	1,486,201	18,619.364	13·2	·97	109·5	78·3	3,696	8/10	·536	1·34	·68	7	688	43	70
Swindon ...	53,000	223,383	2,392,470	10·71	·859	45·14	75	1,955	3/4	·709	1·2	·85	6	...	...	12
Wallasey ...	87,000	1,284,938	13,555,876	10·54	1·15	153·51	99·2	3,190	14/8	·75	1·89	·84	7	388·53	35·5	67
Walsall ...	100,000	720,634	6,752,727	9·371	1·184	68	94	1,905	6/7	·775	1·24	·79	7	315	21	39
Walth'mst'w	130,000	1,146,743	13,499,838	11·77	·732	103	104	3,089	6/4	·618	1·18	·86	7·6	430	37	38
Warrington	86,000	445,459	6,012,212	13·474	·903	69·91	102·24	2,344	5/3	·59	1·246	·803	6·39	180·99	11·937	21
West Ham ...	296,570	3,760,361	42,667,561	11·35	·852	144	90	5,041	10/-	·67	1·85	·50	7·66	1,195·75	93	118
W. Hartlep'l	90,000	479,382	4,261,917	8·89	1·07	47	94	2,163	4/3	·65	1·262	·94	7	203	14	26
Wigan ...	200,000	1,495,786	13,811,709	9·23	1·344	69	97·57	2,427	7/6	·802	1·15	·88	7·4	567	42	73
Wolverh'ton	135,000	1,181,309	12,236,785	10·359	1·06	90·64	89	2,539	8/1	·687	1·25	·879	6·85	651·6	36·2	52
Yarmouth ...	56,000	677,153	4,236,424	6·25	1·239	75·65	80	1,500	7/10	·944	1·25	·76	7	310	23	35
York	82,600	762,540	...	...	...	...	...	...	...	...	...	...	...	...	...	...

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast ...	390,000	6,432,600	62,340,269	9·74	1·02	159	128	2,689	13/8	·60	1·96	·43	8·75	2,014	241	290
Bexley ...	16,500	316,970	2,270,070	7·16	1·55	133	126	2,922	19/10	1·24	1·59	·63	9·5	179	11	16
Birkenhead	157,996	1,209,117	14,822,697	12·25	1·052	107·41	73·46	2,702	9/3	·992	1·39	·66	6·84	483·81	45·09	65
Bournem'uth	120,000	1,815,632	16,967,210	9·34	1·44	141	...	3,103	16/11	·78	1·19	·87	6·8	...	...	91
Cardiff ...	182,729	2,742,846	30,424,407	11·09	1·09	166	85	4,358	15/2	·85	1·44	·736	7·5	1,408	88	130
Coventry ...	135,000	1,100,553	8,730,024	7·9	1·22	65	59	2,832	6/7	·84	1·18	·866	6·2	487	41	51
Glasgow ..	1,150,000	24,214,460	336,260,758	13·887	·764	292·4	105·61	5,404	18/7	·488	2·31	·44	8·11	8,974·78	628·20	856
Huddersfield	160,000	(a) 2,797,276	23,933,065	8·69	1·24	159	84	3,556	15/6	·73	1·34	·69	7·72	1,012·16	63·26	106
Hull	291,118	4,551,145	52,087,770	11·44	·745	178·92	123·43	4,879	11/1	·52	2·75	·384	9	1,565·60	97·85	180
Leeds ...	525,000	9,523,737	95,639,268	10·04	1·075	182	115·43	3,747	16/4	(b) ·884	1·93	·539	7·54	3,465	230	345
Leicester ...	232,644	4,137,262	37,914,773	9·146	·947	163	108·35	4,045	12/10	·751	2·18	·45	8	1,451	...	160
London ...	...	E68,706,161 H 272,631	547,253,332 3,244,661	9·32 11·90	1·02 ·76	...	117·07 77·12	8,465 1,045	... ...	·73 1·21	... ...	... ...	8·95 5·85	17,972 131·80	1,374 10	1,730 37
Newcastle ...	300,000	5,775,323	65,085,452	11·27	1·073	217	...	4,454	18/8	·592	1·58	·633	...	...	...	223
Northampt'n	91,500	690,177	8,295,941	12·02	·89	90·66	...	2,470	6/8	·603	1·34	·7	...	...	...	33
Portsmouth	246,000	2,438,621	27,554,194	11·299	1·061	112·01	90·29	3,535	9/1	·495	1·66	·62	7	1,065	74	100
Preston ...	120,000	1,025,738	10,340,688	10·08	1·04	86·17	132	2,652	7/7	·764	1·01	·95	7·36	404·7	21·3	33
Reading ...	76,500	924,696	8,881,097	9·6	·96	116	114	2,704	9/4	·54	1·59	·68	7·5	336	25	36
Sheffield ...	485,228	8,810,252	107,023,195	12·147	·878	220	108·86	4,950	16/2	·553	2·917	·371	...	3,215·05	221·728	339
Wellington...	70,000	2,328,849	24,565,376	11·28	1·43	359	85	4,708	44/10	1·031	1·125	·89	7·80	840	75	92

E—Electric trolley system. H—Horse lines. (a) Including 9,467 miles coal haulage. (b) Total expenses per passenger.

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COLONIAL TRAMWAYS AND INCOME TAX.

Sir J. D. Rees asked the Chancellor of the Exchequer in the House of Commons on January 24 whether he was aware that the Bombay Tramways Company, in order to avoid the payment of double income-tax, was removing its headquarters from London to Bombay; whether he was aware that many Colonial companies paid a triple income-tax; and whether, in view of the probable removal of many more companies and the net loss involved to the trade and revenue of the United Kingdom, he would endeavour to adjust this grievance in his forthcoming Budget.

Mr. McKenna.—My hon. friend refers to a company which I understand operates a system of tramways outside the United Kingdom, one which is owned predominantly by persons resident in India. These circumstances suggest that considerations other than the incidence of the British income-tax may have influenced the company in its decision.

Evidently the Chancellor of the Exchequer is unaware that the chairmen of several Colonial tramways companies, whose offices are in London, have referred to the payment of double income-tax at their recent annual meetings, and expressed a hope that the injustice may be removed. They base their hopes upon a statement made by the Chancellor to the effect that on the first opportunity after the war the Government would take the opportunity of reforming income-tax law.

Further enlightenment for the Chancellor is afforded by the report of a meeting of Bombay Electric Supply and Tramways Company held in Bombay, when a resolution was passed to transfer the entire administrative control and management from London to Bombay, in order to escape the liability to pay the British income-tax. Sir Sassoon David, chairman of the company, in introducing the subject, said :—" The directors have on more than one occasion striven to obtain, by means of a deputation to the Chancellor of the Exchequer and by other means, relief from this hardship. So far these efforts have not proved successful, although the directors have recently been informed that prior to the outbreak of the war a Committee of the House of Commons had been appointed to report upon the revision of the Income-tax Acts. When the labours of that Committee will be resumed, or what may be their outcome, I am not in a position to inform you. They may, and we hope will, result in relief being granted in the case of English companies which, like our own, earn their entire profits outside of the United Kingdom. But I feel bound to tell you that, in my opinion, any relief, if it be hereafter granted by the British Legislature, will only be partial. Taking the English income-tax as it stands to-day, it means, we estimate, that the company will have to pay a sum of considerably over Rs.2,00,000 on account of that tax, which represents a loss divided between its preference and its ordinary shareholders, and that the following year, even should the tax not be raised above 3s. 6d. in the £, it will have to pay more. Put another way, the present English tax of 17½ per cent., plus the Indian tax of 2¾ per cent., is equivalent to a charge of 20 per cent. per annum on the company's profits, although as a matter of fact these taxes do not really amount to quite that percentage owing to allowances granted for depreciation of plant."

CONTRACTS AND ORDERS.

British Electric Transformer Company have received a contract for the supply of transformers to Liverpool Corporation.

British Westinghouse Company are supplying and erecting a 500-KW. rotary converter set to Salford Council, at £1,450.

Nelson Council have accepted the tender of Messrs. Briggs, Jones and Gibson, of Manchester, for five uniforms for women car conductors.

Southampton Council have placed a contract with Messrs. Driver and Company for the supply of 60,000 deal blocks for the Tramways department.

Bournemouth Tramways Committee have accepted the tender of Walter Macfarlane and Co., at £122 10s., for erecting a shelter at the Poole terminus.

W. T. Henley's Telegraph Works Company have received a contract to supply triple concentric cable and joint boxes to Ilford Council, at £2,319.

C. Mackintosh and Company, Limited, have obtained a contract for mackintoshes and waterproofs for various departments of the Liverpool Corporation.

Sunderland Council have allotted contracts as subjoined :—Ferranti, Limited, meters; Underfeed Stoker Company, Limited, two Underfeed stokers.

Messrs. Burt and Timms have obtained a contract for the construction of permanent way for the Melbourne, Brunswick and Coburg Tramways Trust, at £27,863.

West Bromwich Council have received a recommendation from the Electricity Committee to accept the tender of the New Conveyor Company for an extension of the coal conveyor.

The Acetylene Illuminating Company have received an order from Swindon Council for an acetylene gas plant at a cost of £41, for use in connection with the repair of the tramway track.

Sydney Council have placed contracts as subjoined :—N. Gutheridge, 2,000-KW. Bruce-Peebles motor converter, £8,737; Babcock and Wilcox, Limited, extension of suction ash handling plant.

Rotherham Council have placed the following contract with J. Smith and Company, Limited, Derby :—Inspectors' trousers, 15s. per pair; tunics, 26s.; motormen and conductors' trousers, 11s. 6d. per pair; jackets, 20s.

Salford Tramways Committee have accepted the following tenders :—Brown Bayley's Steelworks, Limited, supply and delivery of 300 steel tramcar tires; Hadfields, Limited, supply and delivery of 14 manganese steel crossings.

British Insulated and Helsby Cables, Ltd., have been awarded a contract to supply, deliver, and erect an overhead line for Nuneaton Electricity Committee, at £436 11s. It is to be of copper, all aluminium having been withdrawn from the market.

Increased Charge for Tickets.—The contractors for the supply of tickets to Colchester Tramways department having refused to execute an order for 300,000 urgently required, unless an additional 1d. per 1,000 was paid, the Tramways Committee have paid the additional amount under protest.

Barnsley Council have accepted the following tenders for extensions to the generating station :—Willans and Robinson, Limited, turbine, £2,590; Dick, Kerr and Company, Limited, alternator, £1,980; Willans and Robinson, Limited, condenser, £2,150; British Insulated and Helsby Cables, Limited, high-tension and low-tension feeders, £2,241.

British Thomson-Houston Company have received an order from Bradford Electricity Committee for a spare rotor for the 3,000-KW. turbo-generators at the electricity works, for an induction motor installation from Chesterfield Council, subject to a loan being sanctioned, and for a motor starter for a 2-ton electric capstan from Bristol Corporation Docks Committee.

Cape Town Municipality have placed a contract with the South African General Electric Company for supplying a British Thomson-Houston turbo-alternator, at £12,160, and with Messrs. Sykes and Company for supplying a motor converter at £3,050, made by Messrs. Bruce Peebles and Company, Limited, who have supplied two similar machines to Cape Town Council.

Leicester Electricity Committee have recommended the acceptance of the following tenders :—Siemens Bros. Dynamo Works, Limited, 1,000-KW. rotary converter and switchgear cables, etc., £2,450; British Electric Transformer Company, Limited, set of 100-KW. transformers, one spare transformer, one 75-KW. single-phase transformer, and one 50-KW. single-phase transformer, £312; G. Fletcher and Company, Limited, coal-handling plant, £1,952.

Stockport Council have placed contracts for tramway supplies as appended :—Hex. nuts, glue, bolts and nuts, Baxendale & Co.; timber, birch floor laths, lifeguards laths, Wilson, Roscoe and Robinson; steel banding wire, British Westinghouse Company; field coils for motors, Dick, Kerr and Company, Limited; bell pushes, P. and B. tape, L. Andrew and Company; hand slipper bracket castings and car step bracket castings, Malleable Steel Castings Company.

Manchester Electricity Committee have allotted tenders as follows :—Musgrave and Company, Limited, set of induced-draught plant; Worthington Pump Company, Limited, steam turbine-driven boiler feed pump; Mather and Platt, Limited, two electrically-driven circulating water pumps; Babcock and Wilcox, Limited, London, coal-conveying plant; Klein Engineering Company, Limited, water cooler; Marple and Gillott, Limited, railway track and crossing; F. Morton and Company, Limited, steelwork, etc., required in boiler-house No. 3; F. Mitchell and Company, Limited, foundations for new cooling towers and boiler-house.

Shepherd's Parging Block Company, Limited, of Milkstone, Rochdale, inform us that the following among other tramways are now using their parging blocks :—Belfast, Bexley, Blackburn, Bolton, Bradford, Burnley, Chester, Colne, Coventry, Darwen, Eccles, Haslingden, Haywood, Ilkeston, Liverpool, Maidstone, Milnrow, Nelson, Oldham, Portsmouth, Preston, Rawtenstall, Rochdale, Rotherham, Salford, Sheffield, Stalybridge, West Hartlepool, Wigan Corporation; St. Annes and Lytham Tramways, South Lancashire Electric Tramways, and Yorkshire Electric Tramways. Orders are also in hand from Doncaster, Gloucester, and Scarborough Corporations.

Extension of Keighley Railless Trolley Installation.—Keighley Council have adopted the Tramways Committee's recommendation to accept the offer of Messrs. Clough, Smith and Company, Limited, to construct the overhead equipment for trolley vehicles from the terminus in Hebden Road, Haworth, to Lowertown, Oxenhope, capital payment to be suspended until six months after the end of the war. The materials will be from the experimental line erected at Hove by " Cedes " Electric Traction, 112, Great Portland Street, London, the price being very favourable in view of the present high cost of materials and labour. The Local Government Board have extended the period for the completion of the overhead equipment on the Oxenhope route until August 7, 1917.

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PERSONAL.

Mr. J. B. Feltham, chief assistant in Gloucester Corporation electricity works, has been appointed electrical engineer to Mexborough Council.

Mr. S. Joyce Thomas has found it necessary, owing to his military duties, to resign his membership of the Highways Committee of the London County Council.

Mr. W. F. Long has been appointed general manager at Cape Town of the Cape Electric Tramways, Limited. For nearly fourteen years Mr. Long has held the position of city electrical engineer at Cape Town.

Mr. E. Manville, of London and Coventry, president of the Associated British Motor Manufacturers, has consented to serve as a member of the Board of Referees in connection with the excess profits duty.

Mr. A. H. Preece, of Messrs. Preece, Cardew, Snell and Rider, of London, arrived at Shanghai in December, and has prepared a report advising the Municipal Council as to the extension of the electricity undertaking.

Professor J. H. Dobson, general manager of Johannesburg Municipal Tramways, and Electric and Gas Supply departments, has been elected President of the Union of South Africa Association of Municipal Electrical Engineers.

Mr. J. E. M. Stewart, who has resigned the post of chief assistant engineer in Leicester Corporation's electricity station, owing to ill-health, was referred to by Alderman Flint, at the Council's January meeting, as a most capable and loyal servant.

Mr. S. J. Clunas, station engineer at the electricity works of the Cape Town Municipality, has been appointed acting city electrical engineer owing to the appointment of Mr. Long, the electrical engineer, as general manager of Cape Town Tramways.

Mr. J. S. Brodie, borough engineer at Blackpool, is to succeed Mr. T. H. Wakelam, county engineer for Middlesbrough, as president of the Institution of Municipal and County Engineers. The annual meeting will be held at Blackpool in June next.

Mr. G. F. Craven, general manager and engineer, Reading Corporation Tramways, has been refused leave of absence to enable him to undertake immediate military service, but no objection was raised to his presenting himself for attestation in the Army Reserve.

Mr. R. A. Brown, chief assistant at Falkirk electricity works, has been appointed burgh electrical engineer to fill a vacancy caused by the resignation of Mr. H. Ranson, who has joined the forces. Mr. Brown was formerly with Glasgow Corporation Tramways.

Mr. A. E. McKenzie, chief assistant engineer, Manchester Electricity Department, has been recommended by the Electricity Committee for promotion to the post of deputy chief engineer, at a salary of £700 per annum, with annual increments of £50 until £800 is reached.

Alderman J. Hill, on January 21, was returned without opposition as Member of Parliament for the Central Division of Bradford, to fill the vacancy caused by the death of Sir George Scott Robertson. The new M.P. has taken a prominent part in the development of the city's tramways.

Second Lieutenant A. R. Courtenay, lately acting manager of the General Electric Company's publicity department, has for two months been serving in France with the Royal Naval Air Corps. He recently transferred to the A.S.C. and proceeded to the Mediterranean Expeditionary Force.

Mr. J. Terry, district traffic superintendent, southern section of the London County Council tramways department, who will attain the age of 65 years on March 2, 1916, is to be retained up to March 2, 1917. The Highways Committee made a recommendation to that effect at a meeting of the Council.

Sir William Middlebrook, M.P. for South Leeds, one of the New Year Knights, was on January 5 the subject of a congratulatory resolution from Leeds Corporation. The Lord Mayor mentioned, among other matters, the new knight's work as chairman of the Local Legislation Committee of the House of Commons.

Mr. W. M. Milnes, electrical engineer to Coventry Tramways and electricity undertakings, has been refused permission by the Tramways Committee to apply for a commission in the army. Mr. H. W. Wale, vice-chairman of the committee, has explained to the Corporation that Mr. Milnes could not be spared. Mr. T. R. Whitehead, the engineer and general manager, was prepared to take on the work, but the committee would not permit him, as he was already "doing the work of a man and a half."

Mr. C. N. Hefford, electrical engineer and manager, Leeds electricity department, has been voted an increase of salary from £600 to £800 per annum. Councillor Lupton, in proposing the increase, stated that Mr. Hefford's predecessor, Mr. Dickinson, was receiving £900 when his services were acquired by Liverpool at £1,000, which had since been increased to £1,500. A year ago Mr. Hefford carried out work for the extension which, if done by a consultant, would have entailed an outlay of 5 per cent., on, roughly, £120,000. While Leeds was sixth on the list of cities and towns in the United Kingdom in the output of current, and third in cheapness of cost, it was twentieth in respect of the salary of the engineer.

Mr. G. N. G. Tucker, of the "Electrician" Printing and Publishing Company, died on January 15, in his 64th year, after an illness extending over several months.

Mr. R. F. S. Venner died on January 24, after a long period of indifferent health. He was greatly esteemed, and was the son of Colonel Venner, of the Indian Army. Mr. Venner, who was one of the original pupils of Faraday House, was inventor of a number of electrical signs. He was the London agent for meters used in recording power consumption on tramcars.

WITH THE FORCES.

Lieut.-Colonel H. C. T. Hildyard, the Paris representative of the South-Eastern and Chatham Railway, who has been on active service throughout the war, has been awarded the Distinguished Service Order.

Sir John Courtis, chairman of Cardiff Tramways Committee, is a member of the Selection Board for Wales who adjudicate upon the fitness of men desirous of entering the Inns of Court Officers' Training Corps.

Regimental Sergeant-Major J. Gill, 23rd Battalion Rifle Brigade, prior to the war was on the traffic staff of Blackpool Corporation Tramways. On attaining his present rank he has been made the recipient of a sword from the non-coms. of the battalion.

Mr. F. W. Mozley, chief engineering assistant to Nelson Corporation, and eldest son of Mr. Henry Mozley, general manager of Burnley Corporation Tramways, has joined the newly-formed engineering company of the Artists' Rifles Officers' Training Corps.

Sergeant W. R. Smethurst, 2nd Battalion Royal Sussex Regiment, formerly a motorman with Salford Corporation Tramways, has been congratulated by the Tramways Committee on being awarded the D.C.M. The resolution is to be engrossed on vellum and presented to the sergeant.

Mr. J. E. Acfield, chief assistant in the office of Leeds city engineer, has received a commission in the Royal Engineers. At the outbreak of the war there were 39 men in the office eligible for enlistment. Twenty-five are now serving with the forces, nine have attested under the Derby scheme, and four have been rejected.

RAILWAY OFFICERS AND STAFF.

Sir Wm. J. Goulding, Bart., has been re-elected chairman of the Irish Railway Clearing House for 1916.

The Right Hon. Lord Joicey, deputy chairman, North Eastern Railway, has accepted the presidency of the Railway Benevolent Institution for 1916.

Sir Thomas Shaughnessy, on whom the King conferred the dignity of a barony on New Year's Day, has taken the title of Lord Shaughnessy of Montreal (Canada), and of Ashford in the County of Limerick, Ireland.

Mr. A. G. Reid has been presented with a silver rose bowl by the Irish Railway Managers' Conference, on the occasion of his retirement from the position of general manager of the Dublin and South-Eastern Railway.

The Right Hon. F. H. Jackson, a director of the Bank of England, has been elected to fill the vacancy on the Board of the London and South Western Railway Company caused by the resignation of the Earl of Selborne, K.G.

Mr. J. Richardson has been presented by the King with the Royal Victorian Medal in recognition of his having had charge of the royal trains on the London, Brighton, and South Coast Railway for forty years. Mr. Richardson has retired from the post of outdoor locomotive superintendent.

Great Eastern Presentations.—Mr. A. C. Hutcherson, on retiring from the position of goods manager for the Cambridge district, has been presented with a gold watch and chain by the chief officers of the company. Mr. H. W. Thornton, general manager, made the presentation, and Mr. W. C. May, chief traffic manager, spoke of the affection entertained for the retiring officer. Mr. S. White up to 1914 had organised 34 annual outings and dinners for the staff of the Liverpool Street offices. In recognition of this voluntary labour the staff have presented him with a cheque for £55 and an illuminated address, Mr. Thornton handing the gifts to the recipient.

G.E.R. Manager and British Trade.—Mr. W. H. Thornton, general manager of the Great Eastern Railway, has given his views on the question of British manufacturers taking steps to capture German trade. He fears that the movement may be weakened by the founding of several overlapping organisations, and he advocates a national affiliation of interests under the direction of some individual whose ability, energy, and past services justify his selection. That person must gather up all the threads of the movement, and act as a head recruiting sergeant in mobilising this country's efforts. Personally he is of opinion that the war is won, though there are still hard knocks and counter-knocks to be given.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.

A New Line.—Trading Departments as Milch Cows.

Messrs. Dick, Kerr and Company, Limited, have completed the construction of an extension of the Birmingham Tramways, from Stratford Road to Shirley Road, Acocks Green, a distance of two miles one furlong. For the most part it consists of double track. The number of the route will be 44, and the city terminus will be either in Station Street or High Street, the full fare being 2½d. On account of the shortage of labour only a limited service will be run. Colonel Druitt, R.E., of the Board of Trade, inspected the new route on January 25, going over it with Councillor Harrison Barrow, chairman of the Tramways Committee, Mr. Alfred Baker, general manager, Mr. Humphries, Deputy City Surveyor, &c. The tramways, electric supply, and gas departments have discussed the amount of the sums that they expect to be able to hand over to the city when their financial year ends on March 31. Last year the tramways voted the sum of £30,000, as against £25,134 for the preceding year, but no announcement regarding this year's allocation is to be made until the Finance Committee have been communicated with. It is stated, however, that the tramways "have had an exceedingly good year, due largely to the increased fares charged during the greater part of the twelve months." In closing an announcement on the matter a local writer says:—"It remains now for the Finance Committee to consider whether they cannot persuade the trading departments to allocate to the relief of the rates a much larger sum from their profits than they appear at present disposed to do." Not a thought is given to the need of track renewals, now being carried out on some sections, or of the higher charges for road maintenance resulting from the use of forty-one motor omnibuses by the tramways department.

BLACKPOOL.

Season Tickets at £3 per Annum.

By 21 votes to 18, Blackpool Council have rejected a motion by Alderman Grime to raise the charge for season tickets to £5 per annum for the whole system, and to make the present £3 ticket available on single sections only. The general manager, Mr. C. Furness, had reported that since the charge of £3 was instituted the various sections had been extended; yet the ticket remained available for the whole of the system, causing a loss of £2,000 a year. He suggested a charge of £4 for a general contract and £3 for a sectional ticket, or else the abolition of contracts. Alderman Grime, in proposing his motion, asked who would have a motor car when they could go "joy riding" all over the tramways for £3 a year. It was only the 2d. ticket on the Promenade line and the patronage of visitors that made the tramways successful, but he doubted whether that assistance would provide the £70,000 required in the near future for relaying two of the sections. He preferred to take the advice of Mr. Furness, because the manager possessed the "business mind." Mr. Furness was too honest to be ruled by the "municipal mind." Upon the latter remark being greeted with laughter, the alderman asked how the undertaking would have provided thousands of pounds for the relief of the rates if the Council had listened to the people who wanted to reduce the promenade fare. The chief opponent of the motion may be said to have admitted the strength of the manager's case when he said that Mr. Furness was a "trained expert with nothing to do except to look after his department."

COVENTRY.

Portable Lamps for Conductors.

The Tramways Committee have ordered small portable electric lamps to be supplied to the conductors.

GATESHEAD.

Serious Mishap—Span Wires in Place of Central Standards.

On February 5, at 7.30 p.m., a single-deck single-truck car was on the up track on Bensham Hill, awaiting a down car on the loop. The latter car failing to move, the driver of the up car applied his brakes and walked towards the down car, whereupon his own vehicle began to run backwards. After going 200 yards, it left the line at a curve, and overturned. Four pedestrians were crushed to death. A passenger and a woman conductor sustained leg fractures. Gateshead Council have agreed to the Tramways Company substituting span wires suspended from standards on each side of the Durham Road from Shipcote to the Low Fell terminus, in place of the existing brackets. The application was granted on condition that the whole of the centre standards on the several tramway routes within Gateshead be removed.

GLASGOW.

Tramway Battalion Facing the Enemy.—A Year's Rates and Taxes.—Record Receipts.

A number of casualties have occurred in the 15th Battalion Highland Light Infantry, composed of Glasgow tramway employees, who are now in France. The battalion was enlisted by Mr. J. Dalrymple, the general manager. The fund collected on the cars to provide comforts has reached a total of £500. Some of the money has been expended in purchasing wool, out of which socks, mittens, etc., have been knitted by the wives and friends of the men and by female members of the tramways staff. For the past year Glasgow Tramways department paid £80,229 in local rates, and £40,967 as income tax. For the seven days ended at midnight on January 8, the tramway receipts were £24,236, a record for a week. For the preceding week the total was £22,774. The previous record was for the week ended September 18, with £23,117, while prior to that the record was made in the New Year week of 1913, when £23,078 was received. Compared with the corresponding week of last year, the new record shows an increase of over £3,000.

LIVERPOOL.

A Successful Year's Trading.

The tramways and electric supply departments combined are contributing even larger sums to the rates than was the case last year, when the tramways undertaking gave £100,000 and the electricity undertaking £25,000. The committee have recommended the granting of the sum of £100,000 from the tramways, and £50,000 from the electricity profits.

LONDON.

Conference to Avoid Waste.—Through Bookings.—Route Number Illumination.—Luminous Stop Indicators.

In order to avoid wasteful competition during the war, an offer was made by the London County Council in July last to participate in a conference with representatives of other London traffic undertakings. Discussions with that object were in progress at the end of January, according to a statement made to the County Council by the Chairman of the Highways Committee (Mr. G. H. Hume). Asked if an offer was made to bring the Council's tramways into the through bookings arrangements devised in connection with the pooling of the receipts of the London underground railways and the General Omnibus Company, Mr. Hume replied in the negative. He observed, however, that through tickets had for several years been issued by underground railway, and, alternatively, tramcar or omnibus, from Charing Cross and the central termini to Highgate, thence to places on the Metropolitan Electric Tramways. Mr Hume also imparted some news concerning other through bookings, which his committee provisionally agreed to some months ago. These bookings are (1) between points on the Harrow Road tramways, the London Electric Railway, and the Metropolitan Railway; (2) from the Council's southern tramways to Leicester Square station of the London Electric Railway, via Charing Cross station, and (3) from the southern tramways to Mansion House station of the District Railway, *via* Blackfriars station. The agreement has not been put in force pending the decision that may be arrived at in the conference already referred to. Improvement is being allowed in the lighting of the indicator boxes of tramcars, while the route numbers of crystal glass on the County Council's cars have been inset with red. On the West Ham cars the route numbers are shown on the dashlight. The number of "request" stopping places has been reduced on the Metropolitan Electric Tramways, and luminous paint has been applied to the standards to make the places more conspicuous at night.

SHEFFIELD.

Combined Power Station.—Traffic Records Surpassed every Week.—Conductor's Action.—War Collections.—Passes for the Blind.

Sheffield Corporation having applied for a Provisional Order to enable the Kelham Island Power Station to be transferred from the Tramways Committee to the Electric Supply Committee, a Local Government Board inquiry was held on January 21. The Lord Mayor (Councillor F. A. Warlow) stated that the scheme was now in operation, and there was no reason to regret the step. Mr. A. R. Fearnley, manager of the tramways department, in giving the inspector statistics of the tramway traffic, stated that although fewer cars were being run at certain times of the day, the number was largely increased at other times for the munition workers Owing to the increased number of munition workers, the system was making records every week. On January 19, for instance, the number of passengers carried was greater than on any previous week-day. The total number of passengers during the week ended January 10 was 2,613,362, as compared with 2,140,166 in the corresponding week of 1915. At Sheffield County Court, on January 7, His Honour Judge Benson delivered judgment in the action brought by an ex-conductor for one week's wages from the Corporation in lieu of a week's holiday. The Tramways Committee decided that where holidays could not be given in 1915 a week's pay would be given. In July, 1915, defendants gave plaintiff notice to leave their service on August 5, no payment being made for the lost week's holiday. The Judge observed that in the ordinary way a man should receive 52 weeks' wages for 51 weeks' work, whereas since his 1914 holiday plaintiff had received only 52 weeks' wages for the full 52 weeks' work. He gave judgment for the plaintiff. Leave to appeal was granted. Two weeks' collections in the cars "To keep the Belgiums alive" resulted in £251 being gathered in. The free passes to blind people have been renewed for a year to the number of 171.

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CAUSE OF THE ASTON ACCIDENT.

The Board of Trade have issued Colonel Druitt's report on his inquiry into the overturning of a Birmingham tramcar at Aston on November 12, resulting in the deaths of three passengers and injuries to others. In the course of the report Colonel Druitt says :—"I think there can be no doubt that the brakes on the car were in perfect order at the time of the accident, and that what probably happened was that Motorman Owen, after leaving the stop at Park Road, let the car coast down the gradient, keeping it under control by means of the hand brake, and that when after passing Pugh Road and approaching the compulsory stop at the bottom of Victoria Road, he found he was going rather too quickly to make an easy stop, he suddenly applied the magnetic track brake to its full extent instead of gradually step by step, and so caused the wheels to pick up. This would perhaps account for the sudden jump the car gave between Pugh Road and the 'stop' described by the conductor, W. Chadwick. If the speed was not greater than nine miles an hour, as stated by Motorman Owen, the car would, I think, have gone round the curve, which is of 150 ft. radius, with a super-elevation for the outer rail of about ¼ in., without being derailed if the wheels had been revolving freely, but if they had picked up owing to the sudden application of the magnetic track brake to its full power, they could not accommodate themselves to the curve, and so the right hand leading wheel hit the nose of the crossing between the two tracks, and the car became derailed and overturned."

The report also states that as the sand-pedal at the driver's end was found to be right home after the accident, it is possible he forgot to place it in the operating position when he changed ends on the car for the return journey.

DEVONPORT ARBITRATION AWARD.

Mr. B. Hall Blyth has issued his award in the arbitration between Plymouth Corporation and Devonport and District Tramway Company to determine the amount to be paid for the Company's undertaking, which had been acquired by agreement. The award directs that the Corporation shall pay the company £103,970 1s. 4d. in respect of :—

(1) The company's tramway undertaking.
(2) The light railway.
(3) The profits the company would have been expected to earn between October 2, 1915, and August 12, 1919.

Each party are to pay their own costs of the reference, and the arbitrator's expenses are to be borne in equal shares by the Corporation and the company.

The award was received by Plymouth Tramways Committee on January 24, when they decided to accept it. A vote of thanks was accorded to the sub-committee and the officials who had been concerned in the arbitration proceedings.

At the company's annual meeting on January 26, the chairman (Mr. C. S. Hilton) said that the amount of the award remained as a loan to the Council at 5 per cent. until that body raised the necessary funds to pay it off, but there was no obligation to do so until after the war.

THE B.E.A.M.A.

ANNUAL GENERAL MEETING.

The annual general meeting of the British Electrical and Allied Manufacturers' Association was held at the Connaught Rooms, Kingsway, London, on Thursday, January 20. Mr. F. R. Davenport (Willans and Robinson, Limited), chairman of the Council, presided. There was a good attendance of members.

In submitting the annual report and balance sheet, the Chairman said that notwithstanding the handicaps under which members were suffering due to shortage of labour, difficulties in obtaining materials, Government control, etc., they had, compared with some other trades, no reason to be dissatisfied with the situation. Public attention was at the present time being largely directed to the question of the probable situation after the war, and several associations purporting to look after that matter, and working more or less on parallel lines, had sprung up. The B.E.A.M.A. had been invited to join some of these associations, but up to the present had not done so, though they had given considerable time to the exchange of views and the holding of conferences, and were still directing their attention to the efforts made towards creating some central and representative body which would embrace the common interests of all British traders. Suggestions had been made by the B.E.A.M.A. to the Colonial Office that money raised within the Empire should be expended on British goods, and whilst the Secretary of State for the Colonies was unable to give any definite assurance, there appeared now to be a far more favourable atmosphere surrounding the whole question of colonial and allied trade. The Association had been in conference with the Advisory Committee of the Commercial Intelligence Department of the Board of Trade, to whom memoranda had been submitted, many of the recommendations put forward being, the Chairman understood, embodied in the report made by this committee. That looked as if things were tending in the right direction. They had been in conference with the Government Research Committee, which was appointed by the Board of Education to inquire into the broad question of scientific and industrial research and for the granting of sums of money in aid of research. Although he had nothing to say at the moment as to probable results, their committee was a strong one, and there was every sign that good results would flow from the effort. With a view to organising and extending the export work of members, additions had been made to the export staff, and Overseas Committees had been appointed in India, Australia, and South Africa. Others, it was hoped, would be shortly appointed. As the report told them, home conditions of contract and standardisation still remained amongst their fundamental activities, and they had been actively engaged in these directions.

In the discussion which followed, Mr. Lundberg (A. P. Lundberg and Sons), Mr. Longbottom (Electromotors, Limited), and Mr. Berry (Berry, Skinner and Company) referred to the unsatisfactory position in regard to patents. Practically all members were now controlled firms, and their patents were naturally in a state of suspension, although patent fees had to be paid. This meant that the useful life of the patent would be shortened by the duration of the war. It was considered that notwithstanding the unsympathetic attitude of the Board of Trade, the matter should be persevered with. The report was adopted, and Callender's Cable and Construction Company, Limited, were elected members of the Council.

The following firms have been elected members :—Ferguson, Pailin and Company, Openshaw; and Mirrlees, Bickerton and Day, Limited, Hazel Grove, near Stockport.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

Adams, A.C.—Side-splash mudguards for motor vehicles (249).
Adams, W. S.—Car trucks (144).
Archer, E. G.—Direction indicators for vehicles (1,031).
Berry, C.—Attachment for use with the starting handle of motor vehicles (161).
Boardman, W. H.—Tires for road vehicles (920).
Bouman, W. F. J. H.—Transmitting signals to railway vehicles (877).
Boys, C. V.—Motor wheel (843).
British Westinghouse Electric and Manufacturing Company.—Starting mechanism for automobiles (198).
Broscombe, H.—Control of measures of vacuum in connection with vacuum brakes (18,113).
Bullers, Ltd.—Supporting and insulating electric lines (1,309).
Cameron, A.—Trolley system of electric tramways (695).
Chadburn, W. and W. R.—Speed and direction indicators (21).
Churchill, J. R.—Tipping bodies for motor vehicles (418).
Craddock, T. F. (*Burn and Co. and another*)—Railway vehicles (935).
Crozier, A. A.—Resilient tire for wheels of motor cars (1,364).
Cucullu, R.—Apparatus for generally handling motor vehicles (258).
Daroowalla, E. B. and K. B.—Signalling for road vehicles (141).
Dixon, H. H.—Fastener for motor vehicle bonnets (1,359).
Dover, H. J.—Means for placing collectors in contact with electric conductors (1,116).
Duncan, R. A.—Control mechanism for preventing excessive speed of motor vehicles (226).
Elliott, J.—Permanent way (302).
Entz, J. B.—Power transmission mechanism, especially applicable to the propulsion of automobiles (18,138).
Eunson, J. W.—Machine for dressing rails (322).
Farnsworth, A. W.—Suspension of self-propelled vehicles (1,077).
Glennie, E. H.—Lifeguard for tramcars (18,158).
Goodwin, W. B.—Mounting vehicle body on chassis (1,275).
Goodwin, W. B.—Spring suspension device of motor vehicles (1,276).
Gray, B. P.—Pneumatic tires for motor vehicle wheels (847).
Hamilton, J. E.—Electric controller for use with electrically-propelled vehicles (70).
Howell, N. G.—Variable speed transmission gear (331).
James, C. A.—Motor vehicle wheels (18,170).
Lomax, F.—Tires for road vehicles (920).
Macfie, R. F.—Motor vehicles (85).
McConway and Torley Company—Car couplings (749).
Milford, F. F.—Motor vehicle wheels (18,170).
Mizen, A. S.—Guide for connecting trolley wheels to overhead wires (235).
Múrua, R.—Apparatus for handling motor vehicles (258).
Navarte, N.—Apparatus for handling motor vehicles (258).
Otermin, A.—Apparatus for handling motor vehicles (258).
Philipson, P. C., T. W. H., and W.—Variable speed driving gear (567).
Piggott, W. C.—Spare rims or wheels for motor vehicles (1,165).
Railway Signal Company—Apparatus for operating railway and tramway signals, points, etc. (229).
Rayner, E. S.—Railway sleepers and rail fasteners (651).

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Roberts, W. S.—Apparatus for operating signals, points, etc. (229).
Schattner, E.—Electric motor starters and controllers (661).
Shepherd, J.W. (*Studholme*)—Differential gear for motor vehicles (431)
Spencer, A.—Bogies for railway vehicles (12).
Sprague Safety Control and Signal Corporation.—Automatic air brake systems (18,213).
Stait-Gardner, F.—Trucks for railway or tramway vehicles (18,215),
Stewart, T.—Pneumatic wheel tires of motor cars (560).
Thomas, J. G. P., and Thomas Transmission, Limited—Power transmission on road or rail trains, etc. (241 and 1,229).
Thomas, S.—Trucks for railway or tramway vehicles (18,215).
Travis, T. G.—Electric motor starters and controllers (661).
Udale, W. S. J., and S. M.—Brake mechanism for trailers (18,192).
Vacuum Brake Company—Means for placing collectors in contact with electric conductors (1,116).
Walker, W. P.—Means for placing collectors in contact with electric conductors (1,116).
Walton, J. R.—Electric motor starters and controllers (661).
Westinghouse Brake Company—Fluid-pressure braking apparatus (588 and 589).
Woods-Gilbert Rail Planer Co.—Machines for dressing rails (322).
Woosnam, A. (*Ambrosini*).—Trailer vehicles (183).
Yanagidate, S.—Fenders for motor cars (476).
Yoxall, J.—Bearing for motor car back axles (719).

Specifications Published.

1914.

Alcock—Means for actuating brakes on moving vehicles from controlling apparatus on the permanent way (23,915).
Dallison—Variable-speed driving mechanism for motor vehicles (22,968)
Irving—Apparatus for controlling railway trains in motion (24,048),
Kerr—Train control apparatus (24,657).
Meyer—Trolley poles or bows for electrical vehicles (24,074).

1915.

Adams—Mudguards for motor vehicles (3,709).
Bell and Jones—Motor road vehicles (4,799).
Betts—Chairs or chair plates for rails and guard rails (16,320).
Betts—Chair plates for railway rails and guard rails (16,321).
Blanke—Signalling devices for vehicles (1,601).
Collet—Machines for grooving and boring railway sleepers (6,099).
Feroci—Automatic railway car and compressed air or steam pipe coupling device (6,158).
Fisher and Ralph—Permanent way (6,690).
Fowler, Livsey and Walker—Portable track wheels for vehicles (665).
Freakley and Aynsley—Resilient tires for road vehicles (6,255).
Humber, Limited, and Burgess—Axle torque members for use on motor vehicles (5,916).
Mosier—Car doors (9,439).
Turner and Donovan—Fluid-pressure braking apparatus (8,378).
Walker—Electric signalling apparatus (3,774).
Walter and Lee—Lifeguards for motor vehicles (1,828).
Whitehead—Tires for motor vehicle wheels (9,263).
Wigley—Automatic danger signal train stopper (9,811).
Wuillot—Combined electrical lighting and starting systems for motor vehicles (190).

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.		1915. WEEKS ENDED.					1916. WEEKS ENDED.					AGGREGATE.		
		Jan. 2.	Jan. 9.	Jan. 16.	Jan. 23.	Jan. 30.	Jan. 1.	Jan. 8.	Jan. 15.	Jan. 22.	Jan. 29.	Wks.	1916.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		60,549	52,720	51,491	49,823	48,728	58,098	50,841	50,239	47,515	47,476	4	196,071	– 6,691
Auckland		...	...	...	...	...	...	...	...	...	...	...	...	...
Burma	Rs.	3,051	3,537	3,435	3,446	3,686	3,222	3,613	3,743	3,475	3,327	...	92,343	+ 6,804
Calcutta	Rs.	60,748	75,317	67,513	61,092	62,912	66,731	80,501	70,455	68,070	65,343	4	284,369	+ 17,535
Hong Kong	$	...	...	...	...	...	...	...	...	...	...	...	...	...
Madras	Rs.	...	(2 weeks)	28,435	(2 weeks)	28,951	...	(2 weeks)	34,257	(2 weeks)	32,126	4	66,383	+ 8,997

Companies Issuing Monthly Statements.

	1914.					1915	1915.					1916	Wks.	AGGREGATE.	
	August.	Sept.	October.	Nov.	December	Jan.	August.	Sept.	October.	Nov.	December	Jan		1915-16.	+ or –.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Brazilian Street Mlrs.	...	...	...	...	...	...	...	...	...	...	...	...	...	—	—
BrazilianTraction Mlrs	6,166,100	6,096,940	6241170	5929730	6,010,490	...	6,576,000	6,494,000	6793000	6336000	6,527,000	...	52	77,113,110	+3,761,632
Brisbane	33,172	28,031	28,763	28,600	30,890	...	35,064	30,360	31,880	31,120	33,960	...	52	372,034	+ 23,923
British Columbia $	674,812	650,516	661,000	648,485	...	...	507,126	517,022	538,826	562,782	...	...	22	2,636,479	– 688,357
Buenos Aires Pt. & C.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Buenos Ayres Lacroze	40,508	40,333	42,341	42,256	44,000	...	41,468	39,355	42,516	42,603	43,528	...	26	250,930	– 1,836
Cape Town	...	...	...	...	...	...	...	13,310	...	13,870	16,589	...	—	—	—
Carthagena& Herrerias	2,758	2,175	1,543	1,379	1,255	904	1,523	1,252	2,169	2,090	2,129	2,841	4	2,841	+ 1,937
Cordoba	13,371	12,384	12,904	12,468	12,091	...	14,157	13,213	13,433	13,785	13,025	...	34	124,148	+ 4,718
East India	2,112	1,980	2,007	2,029	1,839	1,914	2,266	2,054	2,069	2,065	2,062	2,015	26	12,531	+ 650
Kalgoorlie	3,042	2,864	2,525	2,414	...	...	3,165	2,997	2,675	2,611	...	...	48	30,402	+ 1,483
La Plata	4,060	3,598	4,540	4,540	4,452	4,540	4,165	3,894	4,405	4,545	4,564	4,533	4	4,533	– 7
Lima	29,898	28,717	30,646	29,712	...	...	32,011	30,543	32,208	30,703	...	...	48	351,169	– 9,612
Manila ... ... $	128,500	116,300	125,750	129,000	132,500	...	126,650	123,946	124,131	129,447	141,350	...	52	1,495,534	– 108,031
Melbourne	...	...	...	...	...	...	...	61,211	...	...	...	...	—	—	—
Mexico ... ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Montevideo	26,075	25,226	26,500	27,081	28,605	32,459	26,493	25,070	27,167	28,407	31,305	34,252	13	93,964	+ 5,818
Port Elizabeth ...	...	...	...	...	...	...	...	2,927	...	3,110	4,360	...	—	—	—
Puebla ... ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Rangoon	4,629	4,119	4,600	4,405	4,459	4,689	4,510	4,445	4,886	5,028	4,492	4,763	4	4,763	+ 74
Toronto ... ... $	850,639	879,321	849,636	824,634	...	...	762,627	804,902	792,001	851,113	...	...	48	8,793,719	– 502,658
Winnipeg ... $	322,762	310,996	330,562	330,398	...	...	251,189	261,982	286,146	323,025	...	...	48	3,122,620	– 610,281

(*Continued on page 142*)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1915. WEEKS ENDED.					1916. WEEKS ENDED.					AGGREGATE.		
	Jan. 2	Jan. 9	Jan. 16	Jan. 23	Jan. 30	Jan. 1	Jan. 8	Jan. 15	Jan. 22	Jan. 29	Wks.	1916.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1,588	1,947	1,560	1,500	1,485	1,902	2,152	1,804	1,677	1,662	34	61,940	+ 40,133
Accrington Corporation	555	515	480	478	447	617	...	...	...	...	—	—	—
Ayr Corporation	248	233	215	211	208	269	305	244	257	256	37	14,120	+ 930
Bath Electric	*	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1,263	1,232	1,218	1,187	1,137	1,432	1,457	1,408	1,414	1,407	43½	60,322	+ 5,363
Birmingham Corporation	12,931	12,399	12,189	12,173	11,970	15,986	15,999	15,564	15,707	15,616	44	629,379	+ 95,660
Blackburn Corporation	1,281	1,219	981	1,012	1,013	1,232	1,199	1,116	1,076	1,093	43½	55,286	- 45
Blackpool and Fleetwood	431	290	259	266	263	414	380	312	291	294	4	1,356	+ 111
Blackpool Corporation	831	734	611	571	546	891	957	785	697	673	44	72,098	+ 2,379
Bolton Corporation	3,170	2,568	2,482	2,385	2,438	3,040	3,050	2,600	2,665	2,617	44	117,960	— 615
Bournemouth Corporation ...	1,859	1,701	1,708	1,614	1,609	1,998	1,997	1,880	1,910	1,876	44	93,417	+ 5,046
Bradford Corporation	6,125	5,837	6,021	5,680	5,554	5,982	6,244	6,184	6,345	6,261	43	282,274	+ 11,964
Brighton Corporation	881	887	842	778	744	990	940	874	896	913	43½	48,523	+ 859
Bristol	10,125	8,832	8,382	7,587	7,789	13,134	9,515	9,589	9,384	9,366	4	37,855	+ 3,905
Burnley Corporation	1,483	1,519	1,419	1,406	1,376	1,779	1,699	1,689	1,569	1,608	44	70,395	+ 2,540
Burton-on-Trent Corporation ...	311	294	281	258	259	365	316	282	286	264	44	12,525	- 296
Bury Corporation	1,275	1,172	1,170	1,142	1,109	1,368	1,354	1,274	1,278	1,267	44½	59,066	+ 382
Cardiff Corporation	2,722	2,533	2,486	2,393	2,304	2,909	2,806	2,732	2,737	2,715	43	118,034	- 1,004
Chatham and District	969	970	969	945	859	1,301	919	1,038	1,075	1,136	4	4,169	+ 425
Chesterfield Corporation	260	251	248	243	234	316	271	261	262	272	43	11,712	+ 111
Colne Corporation...	219	220	...	...	...	266	246	...	...	...	—	—	—
Cork Electric	414	459	427	422	407	568	414	470	462	446	4	1,792	+ 78
Croydon Corporation	1,661	1,670	1,588	1,431	...	1,761	1,778	1,674	1,665	...	42	77,738	+ 4,966
Derby Corporation	1,060	961	914	901	..	1,244	1,098	1,021	1,060	...	—	—	—
Dover Corporation	260	249	247	235	226	298	266	263	259	275	43	13,479	+ 2,286
Dublin and Lucan	283	136	109	111	107	276	114	113	112	118	4	458	- 5
Dublin United	6,017	5,821	5,695	5,506	5,188	6,324	6,171	6,041	6,018	5,919	4	24,149	+ 1,840
Dundee City	1,265	1,558	1,207	1,178	1,158	1,399	1,704	1,293	1,304	1,281	36½	50,105	+ 2,891
East Ham Corporation	1,176	1,298	1,245	1,204	1,115	1,309	1,349	1,303	1,294	1,271	43½	56,846	+ 5,882
Exeter Corporation	378	341	317	295	272	324	360	335	338	325	43	16,330	+ 925
Gearless Motor Buses	*	...	...	...	...	...	...	...	...	...	—	—	—
Glasgow Corporation	21,857	21,095	19,688	19,969	19,606	22,784	24,252	21,755	21,744	22,297	4	759,192	+ 54,410
Glasgow Subway	954	1,115	1,066	1,103	1,089	1,027	1,290	1,211	1,219	1,257	4	5,167	+ 595
Glossop (Urban Elec. Supply Co.)...	112	108	109	103	101	144	134	131	132	132	5	675	+ 141
Halifax Corporation	2,383	2,025	1,925	1,930	1,884	2,181	1,959	2,066	1,961	1,959	42½	95,227	+ 887
Hastings and District	956	715	778	701	598	1,064	825	773	701	756	4	3,055	+ 263
Huddersfield Corporation	2,474	2,343	2,311	2,337	2,179	2,642	2,642	2,561	2,620	2,666	43	116,372	+ 15,828
Hull Corporation	3,267	3,120	3,074	2,961	2,947	3,421	3,322	3,269	3,219	3,191	43	134,746	— 1,247
Ilford U.D. Council	695	602	577	532	539	677	661	635	629	614	43	28,228	+ 3,210
Ilkeston Corporation	108	111	111	106	109	129	130	129	129	147	44	5,936	+ 332
Ipswich Corporation	434	391	382	367	237	548	501	473	482	474	42	23,747	+ 4,039
Isle of Thanet	289	282	275	237	216	292	268	256	241	254	17	4,471	- 943
Kilmarnock Corporation	204	167	143	142	140	197	199	158	157	160	37	6,261	+ 246
Lanarkshire	1,826	2,360	1,668	1,714	1,659	2,973	2,448	2,068	2,076	2,049	4	8,641	+ 1,240
Lancashire United	1,661	1,772	1,440	1,491	1,445	1,805	1,833	1,593	1,596	1,633	4	6,199	+ 452
Leeds City	8,491	8,038	8,186	7,925	7,710	9,515	9,119	8,893	8,875	9,035	44	391,404	+ 31,227
Leicester Corporation	3,146	2,911	2,824	2,776	2,765	3,651	3,279	3,173	3,234	3,197	4	13,520	+ 1,838
Leith Corporation...	723	697	641	627	633	821	850	759	752	774	37	28,603	+ 2,212
Leyton U. D. Council	1,454	1,232	1,499	1,519	1,328	1,589	1,539	1,516	1,506	1,471	43	69,610	+ 9,389
Liverpool Corporation	12,936	12,849	12,411	12,384	11,896	13,896	14,240	13,672	13,744	13,375	4½	57,183	+ 5,276
Llandudno and Colwyn Bay ...	199	175	167	168	162	189	178	187	195	198	8½	1,575	+ 116
London County Council	*	...	...	...	...	...	...	...	...	...	—	—	—
London General Omnibus... ...	*	...	...	...	...	...	...	...	...	...	—	—	—
London United	*	...	...	...	...	...	...	...	...	...	—	—	—
Lowestoft Corporation	178	159	170	143	138	154	137	127	129	125	16½	2,245	- 749
Maidstone Corporation	173	180	160	154	139	219	214	195	177	181	43	9,432	+ 433
Manchester Corporation	17,161	16,759	16,580	16,547	16,015	17,447	18,334	17,579	17,900	17,745	43	778,294	+ 28,221
Metropolitan Electric Tramways ...	*	...	...	...	..	...	...	...	...	...	—	—	—
National Steam Car	*	...	...	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	152	160	155	145	159	223	191	182	201	202	43½	8,526	+ 524
Newcastle-on-Tyne Corporation ...	5,977	5,920	5,719	5,584	...	5,424	5,930	5,823	5,868	...	—	—	—
Newport (Mon.) Corporation ...	803	769	754	707	693	967	898	862	876	845	44	36,883	+ 1,452
New St. Helens and District ..	954	883	784	809	786	1,097	992	919	911	906	30	31,074	+ 3,213
Northampton Corporation... ...	659	582	564	541	531	686	716	681	701	695	43½	31,510	+ 5,520
Nottingham Corporation	2,962	3,371	3,313	3,296	3,230	3,745	3,713	3,747	3,735	3,740	43	161,618	+ 12,569
Oldham Corporation	2,068	1,930	2,070	1,985	1,937	2,282	2,343	2,290	2,309	2,318	45	102,252	+ 5,191
Portsmouth Corporation	2,155	2,243	2,159	1,993	1,997	2,285	2,339	2,239	2,175	2,133	44	108,120	—
Preston Corporation	834	817	897	884	822	1,023	1,052	1,050	1,004	1,000	43	42,173	+ 2,336
Provincial...	1,974	1,909	1,932	1,813	1,791	2,257	2,157	2,144	2,066	2,061	17½	35,819	+ 2,713
Reading Corporation	679	736	700	618	623	873	750	783	769	751	43½	34,388	+ 3,747
Rhondda Tramways	1,611	955	1,090	1,110	1,078	1,623	1,002	1,183	1,198	1,222	4	4,606	+ 372
Rochdale Corporation	1,539	1,499	1,491	1,443	1,403	1,747	1,703	1,615	1,659	1,700	41½	74,295	+ 3,881
Rotherham Corporation	1,003	923	942	914	925	1,298	1,259	1,272	1,258	1,224	44	52,190	+ 7,039
Salford Corporation	5,041	4,640	4,741	4,583	4,479	5,287	5,241	5,154	5,222	5,181	43½	227,872	+ 10,476
Sheffield Corporation	8,398	7,965	7,917	7,767	7,803	9,446	9,737	9,667	9,687	9,712	44½	402,497	+ 56,423
Southampton Corporation... ...	1,180	1,285	1,214	1,187	1,167	1,483	1,527	1,508	1,441	1,459	43	65,070	+ 7,667
Southend-on-Sea Corporation ...	601	610	606	616	551	651	608	607	591	601	43	35,037	- 7,933
South Metropolitan Tramways ...	*	...	...	...	...	...	...	...	...	...	—	—	—
South Shields Corporation ..	772	727	657	659	638	799	804	740	732	756	43½	34,623	+ 1,620
Sunderland Corporation	1,539	1,304	1,282	1,302	1,245	1,697	1,610	1,481	1,470	1,525	44	66,123	+ 1,850
Sunderland District	633	585	481	484	526	683	694	569	543	603	13	7,398	+ 655
Swindon Corporation	207	172	168	162	...	251	204	187	184	...	—	—	—
Torquay Tramways	545	386	403	377	360	553	394	457	408	434	4	1,695	+ 167
Tramways (M.E.T.) Omnibus Co. ...	*	...	...	...	...	...	...	...	...	...	—	—	—
Tyneside Tramways and Tramroads	567	435	492	493	485	545	366	498	498	509	4	1,871	— 34
Wallasey Corporation	1,109	1,113	1,059	1,031	988	1,238	1,230	1,088	1,163	1,132	43½	55,579	+ 1,290
Walsall Corporation	749	651	697	654	637	997	804	824	815	834	5	3,434	+ 572
Walthamstow U.D. Council ...	767	723	720	681	684	854	789	752	774	782	44	38,823	+ 3,726
Warrington Corporation	410	439	423	421	...	513	511	492	486	...	—	—	—
West Ham Corporation	2,641	2,840	2,841	2,760	2,482	3,070	3,028	2,989	2,987	3,009	43½	133,918	+ 11,612
Wigan Corporation	1,397	1,387	1,384	1,401	434	1,720	1,693	1,572	1,485	1,296	43	65,670	+ 2,542
Wolverhampton Corporation ..	1,061	1,032	1,025	962	1,002	1,217	1,152	1,142	1,149	1,097	44	49,754	+ 3,162
Yorkshire (West Riding)	1,505	1,409	1,434	1,353	1,337	1,799	1,697	1,521	1,595	1,641	5	8,254	+ 1,216

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

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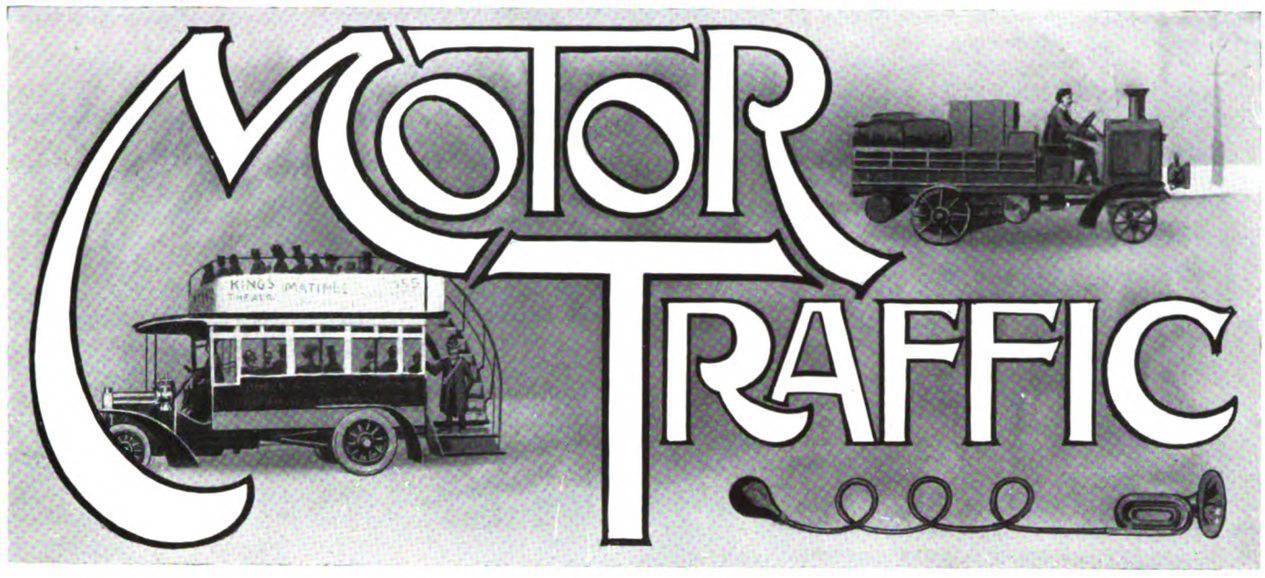

The need of a Traffic Board for London, which has so long been urged, is now emphasised as never before. In times of peace it is disheartening to see transport systems engaged in wasting the money of the ratepayers and of private investors, but at a period when the existence of the Empire depends upon the conservation of its wealth, the continuance of competition is deplorable. Yet an interval of seven months has elapsed before the various undertakings have reached a frame of mind in which they are inclined to consider a proposal to prevent the waste of facilities. No doubt the dominant factor in bringing about the change of attitude is to be found in the impending departure of a number of their employees for Army service. For months, too, one of the greatest arsenals in the country has been crying out for additional means of conveyance for its workmen. Yet empty omnibuses are to be seen on various routes that should have been diverted to the service of the national needs. Beyond the confines of the Metropolis are several small towns whose population furnishes workers both for the arsenal referred to and for a number of large firms engaged on munition work. It was left to the tramway authorities of the aforesaid towns to decide to obtain powers for running omnibuses before the omnibus companies came forward with offers to meet the needs of the community. In these cases the local authorities hold the whip hand. Insignificant as they are in comparison with any of the twenty-nine London boroughs, they possess the power of withholding licences from any company as long as they themselves supply the needs of the locality.

* * * * * *

The remedy for London's traffic muddle is to be found in an extension of the policy that has led to the pooling arrangement just carried into effect among the railway and omnibus members of the Traffic Group. This has been accomplished under the Act obtained last session ; it is not a war expedient, as reported in daily newspapers. While not looking for such a Utopian result as the pooling of the traffic receipts of a public authority with those of private companies, we contend that the people of London are entitled to demand the greatest possible efficiency in their locomotion facilities. That demand can only be satisfied by a continuance of the policy that a few years ago led to inter-running on the northern tramways, and to a willingness to concede a similar advantage south of the Thames right away down to the distant suburbs served by a company undertaking. Equally important to the inter-running concession was the institution of through bookings on an underground railway, a company tramway, and the County Council's tramways. More encouraging still is the news that when the result of the forthcoming conference on facilities is announced, confirmation will be made of the statement published in our columns some months ago, viz., that arrangements have been made for the issue of through tickets between the tramways and the railways at Blackfriars and Charing Cross. If matters concerning exchange of traffic are making such progress, the question may be asked why worry about the Traffic Board recommendation of the Royal Commission and of the Parliamentary Committee of 1912 ? The answer is that matters that should be dealt with from the sole point of view of the public good are made the sport of political factions, and that four years ago the County Council were turned by a newspaper outcry from considering the question of a working agreement. Then also there are the questions of public safety and of road maintenance to be dealt with. In London the latter subject, as far as the omnibuses are concerned, will need separate treatment, for during the war the omnibuses and their drivers are at the call of the military authorities for the conveyance of troops in the case of an emergency, in addition to which they have been used for the transport of refugees and aliens. For military as well as civil reasons omnibuses are as necessary as tramways, and it would be a wise action of the Coalition Government were they at once to create the Traffic Board, making it representative of the several interests involved, with instructions to devise a scheme of working that will do justice to the ratepayers and to the shareholders of the several companies.

The general principles underlying the scheme for the employment of disabled soldiers and sailors that has recently been the subject of discussion at the Royal Automobile Club should commend themselves to every motor owner and user. At the meeting called by the Club of representatives of all the organisations connected with the motor movement to discuss this great question, it was possible to view the problem only in part. Any comprehensive project to deal with the matter as a whole must emanate from our Government acting in conjunction with the Governments of the Oversea Dominions. There are, however, about

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MOTOR TRAFFIC.

all official schemes certain disadvantages. Necessarily such plans are rather of the cast-iron type, both in their framing and in their application. Such complete precautions have to be taken to safeguard their operation against captious criticism that any special consideration of the individual merits of each case is rendered impracticable from the start. Moreover, any such huge scheme must lack the personal touch, and the feeling of any close tie between those who seek assistance and those who offer it. It is quite possible that the main scheme would work best if there existed in affiliation to it a number of sectional schemes each covering a defined area. It is evidently with some such idea as this in mind that the meetings at the Royal Automobile Club have been called. The motoring community, as such, is only concerned with men who have earned their living in some capacity closely connected with the manufacture or use of motors. It would be extremely unwise to elaborate any scheme for the wholesale training as motor drivers of men incapacitated from other occupations. Anything of the kind would be bound, in the long run, to upset the labour market, and to cause ill-feeling and possibly acute labour troubles. The most that could be attempted is something in the nature of a re-shuffling process limited to the motor movement itself. Thus, there are doubtless men who, prior to the war, earned their living as motor drivers, or who during the war have done military or naval work in a similar capacity, but who now are for one reason or another incapacitated from continuing to earn their living as drivers. Physical injury is not the only possible cause of such disability, which might be brought about by rheumatism due to exposure and unfitting a man for rough open-air life, or by eye or nerve strain caused by much night driving over broken roads. On the other hand, there must be men who have hitherto earned their living as mechanicians or in other indoor employment connected with motor manufacture or operation, but whose health has been so far affected by military service as to render them unfitted for anything but an open-air life.

* * * * * *

The first step is apparently to get into touch from now onwards with all the men who come under either category, and at the same time to provide some central point upon which can be focussed offers from those who are willing to take such men and either to employ them straight away, or to train them without charge but with a view to subsequent employment. Doubtless, opportunities for affording some help, compatible with the sound conduct of their own business, will occur to many of our readers. In that case we take it that any suggestions or offers should in the first place be addressed to the Secretary of the Royal Automobile Club. At present the scheme is hardly more than in embryo, but there appears to be no reason to doubt that with the general approval of the various motoring organisations, it will rapidly develop into something practical and really useful.

The future as regards the available supply of motor vehicles is again very clouded. At present, while the private motor car of foreign origin is required to pay an import duty—and the same applies to its components and to accessories generally—nothing has been done to hinder the import and sale of tires and of industrial motor vehicles. It may be possible to draw a rough line classifying private motor cars as luxuries, and industrial vehicles and tires as necessities, but this definition is neither clear nor by any means accurate. Thus, cars for the private use of officials while engaged in their business may be far more in the nature of necessities than vans to be used for the delivery of luxuries, or chars-a-bancs to be employed solely for pleasure trips. It is rather curious that when an endeavour was made to set up an arbitrary distinction of this kind, no attempt was made to apply the same kind of reasoning to tires, separating the solid from the pneumatic. At the present moment, the question of the limitation of imports is being dealt with by a different authority and from a different point of view. The professed objects of the Chancellor of the Exchequer were primarily to level up the rate of exchange, and to prevent people from wasting money upon luxuries. The professed objects of the Board of Trade are, on the other hand, to free tonnage for the ocean transport of absolute necessities. In this connection, the stock in hand in this country available for sale is being taken into account, and, all the circumstances considered, it is well within the bounds of possibility that the motor vehicles will come in for a little attention before very long. To prohibit imports of motor cars would, of course, be to negative the utility of the import duties as a means of raising revenue. Moreover, unless we are mistaken, concessionaires of many of the leading foreign makes of industrial motors have very adequate stocks in hand, so that for the time being at least the export of gold in return for motors would not be stopped entirely. However, if anything at all is to be done in the way of prohibiting unnecessary imports, it is questionable whether there remains any justification for continuing unchecked the free import of foreign motor vehicles of any type. Probably, real necessities can be met by British machines and by the stock of foreign machines already in the country. The process of freeing a portion of the output of our own manufacturers serves incidentally to build up at home a big reserve of lorries of the approved military type, which would be available to the War Department in case of urgent necessity.

* * * * * *

It is impossible as yet to say whether any steps will be taken to prevent further imports of foreign motor vehicles; but all the circumstances taken together appear to point in that direction, and to be steadily increasing in aggregate weight. The consequences of any prohibition would be felt mainly by American firms, and by intending users in this country whose requirements do not in fact represent important necessities. From the point of view of British manufacturers, such a prohibition would not be timed so as to have the maximum effect in securing the future of the home industry. This effect would be produced by a prohibition, not applied at the present moment, but enforced for a reasonably long period following upon the cessation of hostilities, this period corresponding to the time during which the efforts of British manufacturers will have to be concentrated upon the difficult work of re-establishing themselves in the markets from which they have been excluded while their output has been earmarked by the Government.

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MOTOR TRAFFIC.

Attention was recently directed to the fact that hundreds of motor wagons were parked in the streets, while munition workers complained of inadequate means of conveyance. Subsequently steps were taken to organise a detachment of the mechanical transport corps for the purpose of assisting manufacturers engaged upon Government work. Presumably this concession is not applicable to the London area only, as a similar arrangement has since been made at Glasgow, where great delays have occurred on the railways and at the docks. The need is as great elsewhere, notably in the cotton manufacturing district. For many months the dock and railway congestion at Liverpool has prevented manufacturers obtaining adequate delivery of raw material, and they have taken steps to form a company for the running of a fleet of ninety motor vehicles with Manchester as headquarters. The inadequacy of the railway facilities has on more than one occasion led the Liverpool and other tramway authorities to consider a scheme of transporting goods by tramway to Manchester and the intervening towns, but the opposition of the railway companies prevented the scheme from attaining fruition.

NORTH-EAST KENT OMNIBUS SCHEME.

MR. J. M. MCELROY'S ADVICE.—OFFERS BY OMNIBUS COMPANIES.

At a meeting of Erith Urban Council on January 24, the Clerk reported that the Tramways and Electricity Committee had held a conference with representatives of Bexley Council and with Mr. J. M. McElroy, general manager, Manchester Corporation Tramways, who was advising the Minister of Munitions on the question of traffic facilities for Government workers in the district. As a result it had been provisionally agreed that the Erith Council should allow the Bexley Council to run motor omnibuses within the Erith Urban District, subject to the latter Council's consent being first obtained, in consideration of the Bexley Urban District Council, allowing the Erith Council to run motor omnibuses within their area.

The foregoing arrangement was confirmed by the Council, who also decided to apply for a Provisional Order to enable them to run omnibuses in the urban districts of Bexley and Dartford, the rural district of Dartford, and the borough of Woolwich, with the consent of the respective Councils. An amendment of Erith Tramways Act, 1903, is also to be sought to enable the Council to enter into working agreements with local authorities who possess omnibus or tramway powers.

Woolwich Council, on January 26, received a report from the Works Committee urging that Erith Council should be informed that Woolwich would object to the issue of the Provisional Order unless Erith are prepared to make a contribution towards the cost of permanently paving the roads proposed to be used in Woolwich. At present the roads are formed of water-bound macadam, tar sprayed. The Council resolved to agree to the Order being granted, subject to the insertion of a clause that the omnibus service should not be started except with the consent of the Corporation.

The London General Omnibus Company have made an offer to Erith Council to provide facilities in the district, and an offer has also been received from Thos. Tilling, Limited, who already run to Woolwich. The Council appointed a deputation to meet the managers of the companies. Messrs. Tilling have also offered omnibus facilities to the Crayford district, and to discuss the matter with Crayford Parish Council. The latter have referred the matter to Dartford Rural Council.

ILLEGAL LOADING OF VEHICLES.

The Highways Committee of Surrey County Council have reported that good results have been obtained from the provision of a weighbridge at Spa Bottom, Esher, and stated that the county surveyor had been instructed to provide an additional pit upon a site to be approved. Alderman Pain, chairman of the committee, mentioned that £191 had been recovered in fines, which money went to the county. That was not the only good effect, as users of heavy traction were now much more careful to lighten their loads, to the great advantage of the highways.

BRIGHTON OMNIBUS LICENSING.

THE KING V. BRIGHTON CORPORATION.

In the King's Bench Division, on January 11 and 12, the case of the King *v.* Brighton Corporation came on for hearing before the Lord Chief Justice, Mr. Justice Sankey, and Mr. Justice Low. The appended report of the proceedings is abridged from *The Times* Law Report :—

A rule nisi for a mandamus had been obtained on behalf of Messrs. Thomas Tilling, Limited, directing the Town Council of the County Borough of Brighton to show cause why they should not hear and determine, according to law, an application by Messrs. Tilling for licences for hackney carriages and omnibuses, on the ground that the Corporation had not properly exercised the discretion which it had under the Town Police Clauses Act, 1847.

Mr. Montgomery, K.C., and Mr. Rowland Harker appeared for the Town Council ; Mr. Macmorran, K.C., and Mr. Barrington-Ward appeared in support of the rule.

Mr. Montgomery, in opening the case, said that from time to time Messrs. Tilling had applied for omnibus licences for Brighton, but the Council had always refused them. The reason given was that as the streets were narrow there would be danger to the public if competing companies were allowed to use them at the same time. The contention of Messrs. Tilling now was that that was not a sufficient reason for refusal. At Hove licences had been granted to Messrs. Tilling without objection ; the omnibuses therefore ran to and fro between Hove and Brighton, but while within the Brighton boundary they did not pick up passengers, so as to avoid the necessity for licences to ply for hire within that boundary. He submitted that there was no evidence to show that the Council had unduly favoured the local company or had not properly dealt with Messrs. Tilling's application.

Mr. Macmorran read an affidavit in reply. He submitted that the discretion of the Council in dealing with such an application was a discretion which could only be exercised judicially, and a decision which purported to be an exercise of discretion but was really a blind following of a predetermined rule, was not a real decision at all. He referred to R. *v.* Metropolitan Police Commissioner ([1911] 2 K.B., at p. 1,140 ; 27 *The Times* Law Reports, 573) ; Reg. *v.* Barry District Council (16 *The Times* Law Reports, 565) ; Tinkler *v.* Wandsworth, etc. (27 L.J., Ch., 342) ; Wood *v.* Widnes Corporation ([1898] 1 Q.B., 463 ; 14 *The Times* Law Reports, 192). The existing company purchased about £2,000 worth of electricity yearly from the Council, and if owing to competition the company should fail, the electricity undertaking would lose a valuable customer. Admittedly, there was need for additional means of transit ; but the Council had determined not to allow anyone but the old company to supply it, even though at the time of Messrs. Tilling's application the old company was not in a position to supply it. At the time of the application for omnibus licences by Messrs. Tilling there was also an application by them for chars-a-bancs licences. The old company also applied for chars-a-bancs licences, but the Council, without having assigned any reason, refused Messrs. Tilling's application and licensed a larger number of vehicles to the old company to make up the number required in the public interest.

Mr. Montgomery replied. He said that a mandamus should not be granted unless it had been shown that some definite wrong thing had been done.

THE JUDGMENT.

On January 20 the Lord Chief Justice, in giving judgment, said the only question was whether there was evidence to show that in refusing the licences for omnibuses the Council had acted from bias or in an improper exercise of their discretion. It appeared that the Council had taken the advice of the Chief Constable upon the traffic conditions, and had been guided by his opinion, and the Court could not possibly say that they had been actuated by improper or immaterial considerations. As regards the omnibus licences, therefore, the rule must be discharged. The case of the chars-a-bancs was somewhat different. The Watch Committee had recommended that licences should be granted to Tilling's for chars-a-bancs, and the Council had refused Tilling's application and had granted licences for extra chars-a-bancs to the local company. They had given no reason for their refusal, and in the circumstances he felt that Tilling's had made out a *prima facie* case. The principle on which the Court acted in such a case was laid down in Sharp *v.* Wakefield ([1891] A.C., 179 ; 7 *The Times* Law Reports, 389), and Reg. *v.* Bowman ([1898], 1 Q.B., 666 ; 14 *The Times* Law Reports, 303), and R. *v.* London County Council (2 K.B., at 475). The Court should be very slow to interfere with the decision of local authorities. It was the policy of Parliament to leave the decision of certain matters to those authorities, and the Court had always

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taken the view that it could not interfere with a decision reached by a local authority that had dealt with a case on its merits without considering matters which were inadmissible, even though on the facts the Court itself would have come to a different determination. But it was the duty of the Court to interfere when it came to the conclusion that the local authority had not properly exercised its discretion and had been influenced by extraneous matters. He was sure that the Council had not intended to do anything that was not according to law, but it had strayed from the path marked out by law. So far as regarded the chars-a-bancs the rule must be made absolute.

Mr. Justice Sankey delivered judgment, in which he agreed on both points.

Mr. Justice Low said that he agreed as to the omnibus licences, but he felt some doubt as to the chars-a-bancs licences. He was not, however, prepared to dissent from the other members of the Court.

The rule was discharged as to the omnibuses and was made absolute as to the chars-a-bancs, with no order as to costs.

HILL-CLIMBING BY A DAIMLER LORRY.

One of the accompanying illustrations shows a Daimler 2-ton lorry belonging to Messrs. Walker and Sons, Whitehaven, mounting a hill leading to their tannery. It is often the case in photographs of gradients that the latter appear less steep than they really are, and this is so in the present instance, but an idea of the great steepness may be got from the second view. The incline is, indeed, a severe test for any fully laden motor lorry. The Daimler makes four or five daily trips up and down this gradient, a fact which speaks well for the power and reliability of the vehicle.

BIRMINGHAM'S OMNIBUS FLEET.

Birmingham Tramways Committee on January 19 decided to purchase six additional omnibuses with Daimler chassis and Allen bodies, with garden seats in the fore part of the saloon. The department are already running forty-one omnibuses, having taken over the local omnibus company two years ago.

We have received the following letter in regard to the order mentioned above from Mr. Percy Frost-Smith, joint managing director of Messrs. Tilling-Stevens, Limited, of Victoria Works, Maidstone :—

"January 25, 1916.

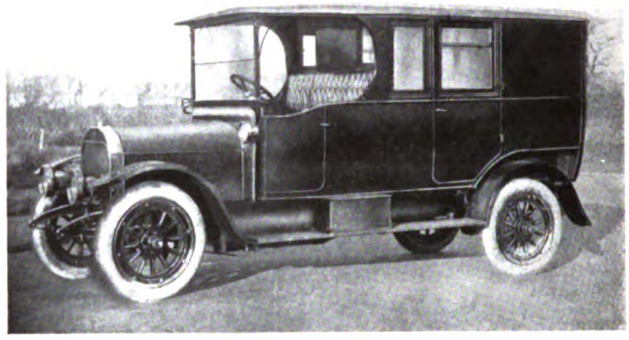
"With reference to the recent order for omnibuses placed by the Birmingham Corporation, we beg to draw your attention to the following :—

"The order for these 'buses was actually placed by the Birmingham Corporation with us on December 16 last, subject to our being able to obtain permission for their manufacture from the Ministry of Munitions. However, having regard to the fact that we are engaged on most important work for the Admiralty and the War Office, we were not allowed to build, and the order therefore was passed to the Daimler Company.

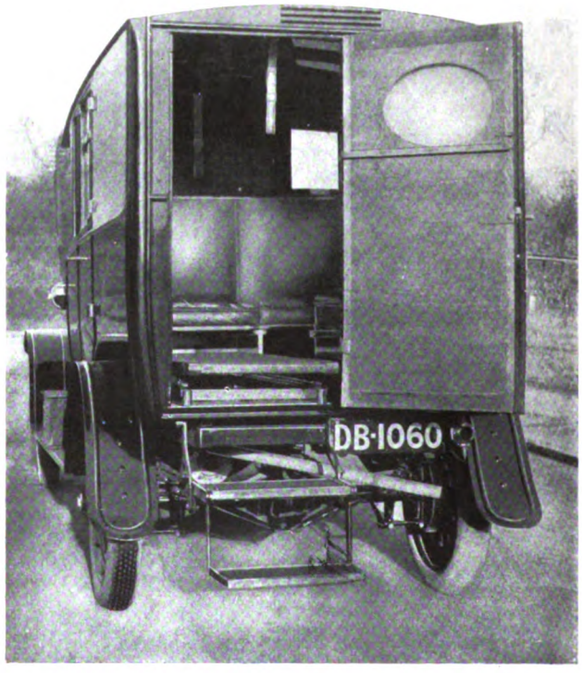
"The fact that this order went elsewhere naturally reacts on us, as the whole of the 'buses running in the Birmingham district are of our manufacture, and if the reason for the loss of this order is not generally understood, it will certainly be detrimental to our immediate and future interests."

DENNIS BROUGHAM AMBULANCE.

The accompanying photographs illustrate a brougham ambulance specially constructed by Messrs. Dennis Brothers, of Onslow Works, Guildford, for the Bromley Board of Guardians, Kent. When arranged as an ambulance the vehicle will carry two patients in a prone position. When used as a brougham, a seat and squab are provided across the back of the body, and the rear door is locked from the inside to prevent it from coming open. The photographs clearly show the difference between the civilian and military requirements in respect of ambulance vehicles,



Dennis Motor Brougham Ambulance.



Rear View of Dennis Ambulance.

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MOTOR TRAFFIC.

A NAPIER LORRY SUSPENDED BY ITS GEAR BOX.

Lance-Corporal Parris, of one of the advanced M.T. depots in France, has sent to D. Napier and Sons, Limited, the interesting photograph which we reproduce on this page. It shows a Napier 3½-ton motor lorry of the B58 type, such as is used for transport work, in an unfortunate predicament. The accident occurred as the result of a skid whilst the lorry was travelling at a high speed on a greasy road. After breaking through the rail of the bridge, the car fell into the position in which it is seen. While the car appears to be resting on the bank, the only thing that is keeping it on the bridge is, in fact, the gear box. Had the car slipped from the position shown, it would have had a drop of 20 feet before it touched the water. The driver had a very narrow escape, having to climb up from the side, and he fortunately got away without injury. The car remained in the position shown in the photograph until it could be replaced on the bridge. When this was done it was found that there was scarcely any damage, which speaks highly of the strength of the frame and of the gear box. The incident affords another proof of the Napier quality, which has been so well borne out during the course of the present war.

A Napier Lorry saved by its Gear Box.

MOTORS FOR THE ARMY.

In the Law Courts on January 21 an injunction was applied for against three Belgians and others. Counsel stated that the Belgians came to this country on the outbreak of the war and formed a company with a capital of £1,608. They obtained orders from the Belgian and British Governments for lorries, etc., amounting to over £1,000,000. After doing a certain amount of work, they received as guarantee from the Belgian Government a sum of £174,000. They proceeded to draw about £130,000 and divide it equally between them, but ultimately were arrested and deported to Calais. An injunction was now applied for with a view to tracing what had become of the money. The Judge granted an injunction restraining any dealings with certain banking accounts and stocks and shares held by the defendants.

PARCEL POST BY ELECTRIC VEHICLES.

A Report on Tests in American Cities.

The Electric Vehicle Association of America recently issued a report on the use of electric vehicles in parcel post delivery and mail collection at a number of different points in the United States. In a demonstration in Denver, a total of 46·3 miles was covered in 7 hours and 12 minutes, and an actual running time of 6 hours and 23 minutes. One hundred and fifty packages were delivered and 143 stops made, so that the time consumed in driving to and making the delivery at each stop was 2 minutes 40·7 seconds, and the average time of driving to and delivering each package 2 minutes 33·2 seconds. The average number of stops per mile was 3·06. This was a 1,000 pound van with a capacity of 18·14 KW.H. The energy consumed was 14·1 KW.H., which at 1·8d., the local rate, works out to 2s. 1·35d., or ·5d. per mile, or ·175d. per stop, or ·165d. per package.

Another demonstration was made of the collection of mail, using the same van, when 26·5 miles were covered in 4 hours and 28 minutes. During this time 147 collections were made, with 137 stops. The average time consumed in driving to and making the stops was 1 minute 57·3 seconds, and the average time in driving to and making each collection was 1 minute 49·4 seconds. The average number of stops per mile was 5·17. The cost of current in this case worked out to 22·3d., being 12·39 KW.H. at 1·8d., making the cost per mile 0·85d., the cost per stop ·16d., and the cost per collection ·15d.

Results in New York City.

For postal service in the United States it seems evident, the report adds, that the motor must necessarily supersede the horse, and during the past five or six years a number of motor vehicles have been employed. Conspicuous among these has been the satisfactory performance of 20 to 30 electric cars in service in New York City during the four-year contract period closed last year. Twelve of these trucks were employed on the introduction of the parcel post in the United States, and are now in service, making

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deliveries from nineteen postal sub-stations in New York to addresses of large and heavy packages sent through the parcel post.

During one winter month, in 27 days these machines travelled 7,111 miles, and delivered 98,243 parcels. At this rate the parcel post truck fleet covered an average distance of 263 miles per day, or 22 miles per individual vehicle. These vehicles, it should be noted, have, however, capacities of 45 miles per charge. Deliveries were made at the rate of 3,628 parcels per day, or about 303 per day per vehicle. The average distance travelled per package delivered was 0·0724 miles, or 382 feet. At the rental paid by the Government for this delivery service, the average cost per parcel was 1·65d., not including the wages of the carrier, who accompanied the truck on its round.

A number of large machines are used for mail haulage between the New York City depots and postal stations. Some of these cars have been in service five or six years, having been used twenty-four hours per day in the year during much of this period.

Cost of Delivering 271 Parcels.

Three electric delivery wagons used by the Indianapolis Post Office have proved very reliable, and it is declared have never failed to perform any service to which they were put. In point of speed and mileage they have been found ample for parcel delivery. In a seven-hour working day the wagons averaged 271·5 parcels in 189 stops over a distance of 18·75 miles. The cost of the day's run, not including the wages of the carrier, was 23s. 3·5d. The unit costs were :—Stops per mile, 6·02 ; cost per stop, 1·625d.; cost per parcel, 1·03d.

Last year the Parcel Post Delivery Committee of the Electric Vehicle Association of America conducted a very extensive campaign with the Government officials at Washington, the postmasters generally throughout the country, central stations, and electric vehicle manufacturers, with the object of inducing the Post Office authorities to recognise the value which had been credited by the most conservative business organisations throughout the country to the electric vehicle as a transportation utility in city services.

Parcel Delivery by Electric Vehicle.

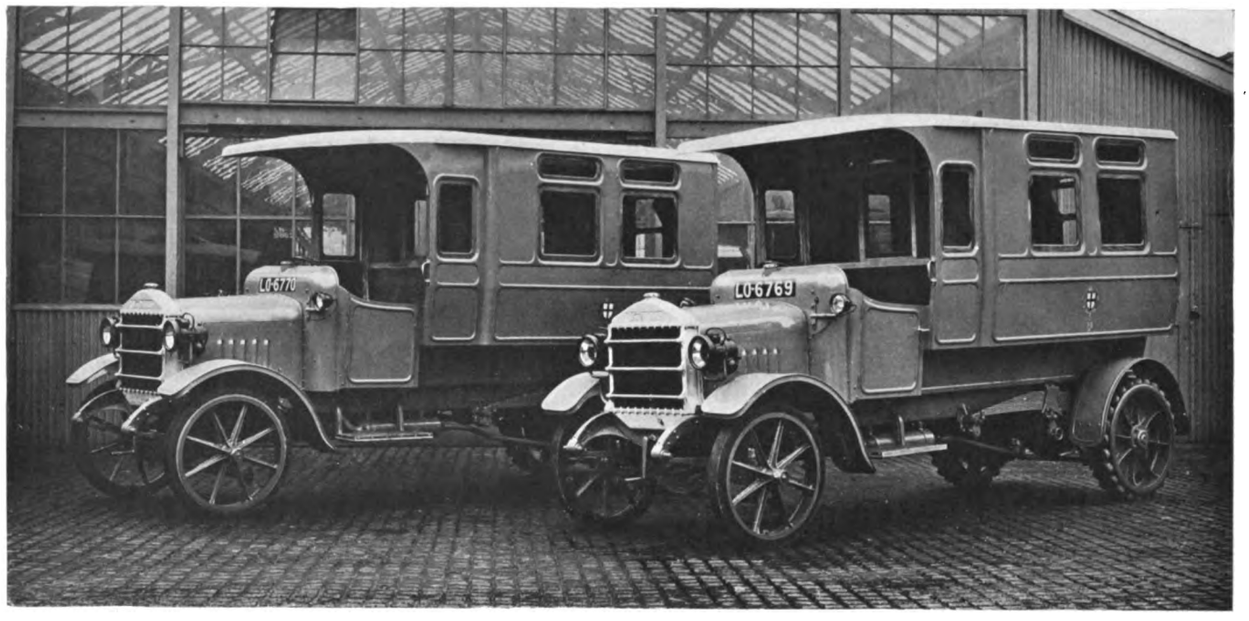
The comprehensive delivery system of Marshall, Field and Company, Chicago, the *Electrical News* states, is one of the best examples of the success of the electric vehicle in a house-to-house delivery. There are at present 230 electrics used by Marshall, Field and Company, which have an average mileage of 28 to 30 miles per day, some of the lighter vehicles travelling as far as 40 miles per day. To do the same work from 850 to 900 horses would be required.

The following is a list of some of the largest electric vehicle fleets in three other cities, gasoline (petrol) trucks being used for long hauls :- -Ward Baking Company, 610 electric, 42 gasoline trucks ; Adams Express Company, 326 electric, 160 gasoline trucks ; American Express Company, 220 electric, 154 gasoline trucks ; Jacob Rupert, 145 electric, 37 gasoline trucks ; Geo. Ehret Brewery, 136 electric ; Commonwealth Edison, 114 electric, 2 gasoline trucks ; N. E. Edison, 130 electric, 3 gasoline trucks ; Gimble Brothers, 110 electric, 97 gasoline trucks ; Carson Pirie and Scott, 67 electric, 21 gasoline trucks.

STRAKER AMBULANCES FOR LONDON ASYLUMS.

The two vehicles illustrated below are the latest acquisition of the Metropolitan Asylums Board for the service of their ever-increasing radius of medical activities. The vehicles represent a departure from the standard practice, inasmuch as the type is of a general description, and the vehicles can be used as omnibuses for carrying convalescent cases or for stretcher work where the patients cannot sit.

Apart from this feature, the specification contains some special points. When a machine of this description is used for carrying stretcher cases only, the conditions to be met are, of course, very different from those when the vehicle is used as an omnibus. The problem thus presented has been solved by Mr. E. Kemp, the chief and consulting engineer to the Asylums Board, by the selection of a " C.T.K." type Straker-Squire chassis, which has a high reputation for smooth running. By specifying the " North " system of adjustable springing, Mr. Kemp has obtained a vehicle which readily takes a variety of loads and yet maintains its flexibility.



Straker-Squire Ambulances.

LONDON FATALITIES IN 1915.

Totals for the Various Types of Vehicle.

In the House of Commons, on January 20, Mr. Kellaway asked the Home Secretary how many street traffic fatalities were caused by each class of vehicle during the years 1913, 1914, and 1915, respectively, in the Metropolitan police district and the City of London.

Mr. Herbert Samuel : The total number of fatalities in 1913 and 1914 was 625 and 658 respectively. Particulars showing the number caused by different classes of vehicles in each of these years were given to my hon. friend in reply to his question of November 9 last. The figures for 1915 are as follow :—

Horse-drawn :—	
Cabs	1
Broughams	9
Trade and commercial	162
Mechanically-propelled :—	
Omnibuses	156
Tramcars	87
Cabs	66
Private motor cars	191
Motor cycles	28
Trade and commercial	150
Pedal (i.e., push) cycles	13
Horses (ridden or led)	4

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MOTOR TRAFFIC.

INSPECTION OF COMMERCIAL MOTORS.

The tenth annual inspection of commercial motor vehicles, organised by the Commercial Motor Users' Association, with the object of encouraging drivers, by means of money prizes and other awards, to take a personal interest in the driving and condition of their vehicles, and to run them without accident, will take place in London during the month of May, 1916. The usual parade of vehicles will not be held this year, owing to the difficulty of sparing vehicles from service during the present period of stress.

The organisation of these inspections, which are supported by the Royal Automobile Club and the Society of Motor Manufacturers and Traders, is in the hands of a special committee. The prize fund is subscribed by users, and by manufacturers and suppliers of vehicles, tires, bodies, fuels, and accessories. Prizes will be awarded to drivers for results obtained in written and in oral examinations, coupled with inspection of their vehicles under running conditions. In this way it is hoped to carry on the educational work among drivers, which has been one of the aims of the Association since its formation in 1903.

Entries had to be received not later than January 15, 1916. They may be for—

(*a*) Oral examination for drivers of steam vehicles and tractors.
(*b*) Written examination for drivers of steam vehicles and tractors.
(*c*) Oral examination for drivers of petrol vehicles.
(*d*) Written examination for drivers of petrol vehicles.
(*e*) Oral examination for drivers of electric vehicles.
(*f*) Written examination for drivers of electric vehicles.

Drivers may enter for all three subjects, steam, petrol, and electric, in either oral or written ; but no driver may enter for examinations (*a*) and (*b*), (*c*) and (*d*), or (*e*) and (*f*).

Members of the C.M.U.A. may enter any number of their drivers free, and non-members upon payment of a fee of 10s. for each driver entered.

The examinations will be based on the information contained in the lectures delivered by the inspecting engineer (Mr. G. W. Watson) during 1915, which have been published in book form under the title of "The Commercial Motor Drivers' Handbook." The foregoing lectures will be supplemented by general reviews and problems relating to steam, petrol and electric vehicles, which will be printed and sent to the drivers by post. The oral examinations will be spread over several evenings, and the written examinations will be held on separate evenings.

The inspecting engineer will visit each garage before the written and oral examinations, and his reports on those visits, together with the marks obtained by each driver in the examinations, will be recorded by the committee, of which Mr. W. G. Lobjoit is chairman, and awards based thereon. Each driver obtaining more than a fixed percentage of marks will receive a money prize, a badge, or a certificate.

The following cash prizes will be awarded by the Inspection Committee :—

CHAMPIONSHIP PRIZES (WRITTEN EXAMINATION).

Steam.—£5, £3, £2, and ten prizes of £1.
Petrol.—£5, £3, £2, and ten prizes of £1.
Electric (provided by the Electric Vehicle Committee of the Incorporated Municipal Electrical Association).—£5, £3, and £2.

The winners of 1st, 2nd, and 3rd prizes will each receive a special badge and certificate, whilst £1 prize winners and each driver who gains more than a certain percentage of marks will also receive a certificate. Winners of 1st prizes in the 1913, 1914, or 1915 examinations are not eligible to take a 1st or 2nd prize in this section, but they will be allowed to sit for their examination, and their order of merit will be announced.

C.M.U.A. GENERAL PRIZES (ORAL EXAMINATION).

These prizes, which will amount to about £50 in total value, subdivided into cash prizes of £2, £1, and 10s., will be awarded at the discretion of the Inspection Committee to drivers of vehicles, based on the number of marks awarded. Drivers who do well in this examination will also receive certificates.

The first entries received were 11 drivers of the Gas Light and Coke Company, and 7 drivers of the Stores Department of the General Post Office.

COMMER CARS EMPLOYEES' WAR FUNDS.—The employees of Commercial Cars, Limited, Luton Works, have sent £75 to the Bedfordshire Territorial Force Comforts Fund and £25 to the Bedfordshire Prisoners of War Fund. The total of £100 represents 50 per cent. of the contributions to Commercial Cars, Limited, Annual Christmas Fund, the workmen thus sacrificing money that they had subscribed for their own enjoyment.

MOTOR VEHICLES FOR MUNICIPALITIES.

MALVERN COUNCIL have bought a motor car for the use of the gas manager.

SELBY COUNCIL have applied for sanction to borrowing £1,100 for the purchase of a petrol fire engine.

NORTHAMPTONSHIRE COUNTY COUNCIL have adopted a proposal to purchase two motor tractors and four wagons.

RAMSGATE COUNCIL are considering the question of purchasing electric wagons for the collection of house refuse.

BRADFORD SEWAGE COMMITTEE have agreed to purchase a motor car for the resident engineer "at a cost not exceeding £175."

BRADFORD CLEANSING COMMITTEE have advised the Council to purchase an additional 6-ton Yorkshire Commercial motor wagon.

DOVER COUNCIL were informed at their January meeting that the three Edison electric dust vans are giving satisfaction. Three similar vehicles are on order.

GLASGOW COUNCIL have consented to the employment of women to replace the drivers who will be called up for service from the Corporation's motor car garage.

SHEFFIELD HEALTH DEPARTMENT have accepted the offer of the electric supply department to provide, at a cost of £185, switchboards and fittings for charging electric vehicles.

MOTHERWELL COUNCIL have been advised by the Streets Committee to appoint a committee to consider the question of adopting motor traction for street cleansing and other work.

WALSALL CORPORATION have received delivery from the Daimler Company, Coventry, of three motor omnibuses that have been urgently required for meeting the demands of the traffic.

BIRKENHEAD COUNCIL recently took delivery of a 60 H.P. 400-gallon turbine motor fire engine from Dennis Brothers (1913), Limited. The machine was driven from Guildford to its destination.

NEWCASTLE ON-TYNE COUNCIL submitted evidence at a Local Government Board inquiry on January 27 in support of their application to be allowed to obtain a loan for the purchase of a motor fire engine and accessories.

SOUTH SHIELDS COUNCIL have adopted the recommendation of the electric supply department for the purchase of an electric tipping wagon to be used for conveying ashes from the electricity works. The cost of the vehicle is estimated at £850.

STOCKPORT ELECTRICITY COMMITTEE have placed an order with the Yorkshire Commercial Motor Company for a five-six ton steam wagon, fitted with mechanically-operated end-tipping body 12 ft. by 6 ft. 6 in. by 3 ft. deep, with rubber tires and three-speed gear, at £695.

ABERDARE COUNCIL, before putting into force their powers to run motor omnibuses in connection with their railless trolley cars, have consulted Mr. S. Sellon as to the most suitable type of vehicle to purchase. The chairman of the Tramways Committee and the tramways manager have visited York and Sheffield and inspected the vehicles in use in those cities, and they have advised the Council to adopt petrol cars as likely to prove more suitable for the hilly nature of the district.

SPEED AT NIGHT.

In reference to an agitation in London to secure a reduction of motor omnibus speed at night, it may be mentioned that the time tables of the London General Omnibus Company have been twice extended since the war began. An official of the company has stated that he could not advocate reducing the speed of night traffic to eight miles an hour, as there is no necessity for any driver to drive furiously, no penalty being imposed for delays. Safety of the road, added the official, is the consideration first urged upon all. Although over 2,000 of the most experienced drivers were on war service, the list of fatal accidents of the company was six less last year, the totals for the past two years being 120 and 126.

Croydon Corporation, on January 24, adopted a recommendation from the Roads Committee that "a representation be made to the Commissioner of Police for the Metropolis of the desirability of reducing after dark the speed of the motor omnibuses travelling in the borough, and with regard also to the regulation of motor omnibus traffic, particularly in relation to recognised places where these vehicles are likely to clash with the fixed stopping place of the tramcars."

Birmingham Tramways Department, on January 17, reduced the speed of their omnibuses and shortened the Moseley end of the New Street and Moseley route owing to the stringent lighting regulations that came into force on January 10. The alterations have been made in order to ensure the vehicles running to time.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

C. C. Vandervell and Company, Limited, have received a large repeat order for electric lighting sets from the London General Omnibus Company.

Post Office Tire Contract.—The Postmaster-General has placed a contract with the Midland Rubber Company for the supply of solid rubber tires for a period of twelve months.

London County Council Vans for War Service.—The Stores Committee of the London County Council have placed at the disposal of the War Department two motor vans that were in course of construction by Thomas Tilling, Ltd.

Corporation Omnibuses and Road Widening.—Sheffield Tramways Committee have agreed to contribute one-third of the estimated cost of widening the road on the Lodge Moor route used by the motor omnibuses of the department.

Lack of Omnibuses and Drivers.—Owing to inability to obtain the necessary omnibuses and drivers, Rotherham Tramways Committee have not been able to inaugurate the proposed motor-omnibus service between Greasborough and Rotherham.

Motor Cars for Parcels.—Mr. A. Ellis, general manager, Cardiff Corporation Tramways, has stated that if motor cars had been obtainable the parcels department at Christmas would have been developed with relays of motor cars in collection and delivery.

Double Fares on Night Omnibuses.—In order to recoup the company for the loss entailed by the running of the night omnibus service from Cricklewood to Liverpool Street, the fares have been increased approximately 100 per cent. Fivepenny tickets, however, are only raised to eightpence.

Curtailed Services at Macclesfield.—Owing to the shortage of labour the motor omnibus services in Wilmslow and Macclesfield districts have been curtailed, while penny stages have been abolished. On account of the latter occurrence, Wilmslow Council have decided not to grant further licences until penny stages are resumed.

Front Wheel Guards.—The London General Omnibus Company are experimenting with two oval rings of rubber fixed in advance of each of the front wheels of some of their vehicles. The lowest of the rings is about three inches from the ground. All the London companies' omnibuses are now provided with the rear wheel guards first introduced by Mr. Iden, the chief engineer of the London General.

Useful Publicity Work.—The latest advertisement issued by the London General Omnibus Company reads as follows:—"Hailing a 'bus in the darkened streets.—When hailing a 'bus, passengers should stand as near as possible to a street lamp, and give a signal to stop the 'bus by holding up the hand. This gives the motor-'bus driver an opportunity of seeing a passenger some yards in advance and bringing the 'bus to a stop."

Utility of Omnibuses to a Tramway Undertaking.—The utility of the motor omnibus was demonstrated in the suburban area of Aberdeen on January 13. During a gale a tree was uprooted and in its fall brought down a considerable length of overhead wire on the track of the Suburban Tramways Company. Mr. A. Wilkie the manager, arranged an omnibus service during the two hours that the tramways were interrupted.

Edison Chassis with Tipping Body.—An error crept into the description, published in our issue dated January 13, of the Edison electric chassis supplied with tipping bodies to various corporations. The power capacity and the capacity of the body there stated are those of a small vehicle supplied to another corporation. The correct power capacity was given on page 71 in the description of the 2-ton chassis. Body capacity varies according to the cubic weight of material.

Colour of Tire Material.—Mr. P. W. Litchfield, the factory manager of the Goodyear Tyre and Rubber Company, says it is quite unsafe for any amateur to attempt to assess the value of a tire from the colour of the material of which a tire is made. It would therefore be regrettable if motorists permitted themselves to become prejudiced on the point of colour. The consequence of their doing so would merely be to limit the useful investigations that are continuously being carried on by experts.

Women Omnibus Conductors.—Owing to the number of conductors who have to take up duty under the Military Service Act, and to the impossibility of replacing them by men, the London General Omnibus Company have now decided to employ women. The sex has been so employed on the vehicles of Thomas Tilling, Limited, since November 2, within two weeks of the withdrawal of the police prohibition. On the Tilling-Stevens vehicles, owing to the absence of jolting in starting and stopping, the work is less arduous than it is likely to be on the petrol machines.

An Opening for Motor Vehicles.—Subject to the North British Railway Company obtaining the consent of the Secretary for Scotland "to carry on the business in all its departments," the company will, on July 1, take over the carting business of Messrs. Mutter, Howey and Company, of Edinburgh, for £63,077. The firm has for many years acted as carting contractors for the company in Aberdeen, Bathgate, Berwick-on-Tweed, Dundee, Dunfermline, Edinburgh, Galashiels, Hawick, Kelso, Kirkcaldy, and Sinclairtown Leith, Linlithgow, etc.

Orders for Dennis Vehicles.—Dennis Brothers, Limited, of Onslow Works, Guildford, have received an order from the Blackpool Tradesmen's Association for an ambulance exactly similar in all details to the special type of ambulance built by Messrs. Dennis for the London County Council. Repeat orders for motor vehicles have been received from Messrs. Lever Brothers and the British Petroleum Company, and standard subsidy lorries have been supplied to Messrs. C. and G. Yeoman, of Canterbury, the Hants. and Wilts. Laundry Company, Nottingham Corporation Tramways, Messrs. Henry Ashwell, of Nottingham, etc.

Electric Starting of Commercial Vehicles.—The engineering department of the Reo Motor Truck Company, of Lansing, Mich., as the result of a series of experiments with their new 15-cwt. petrol motor delivery van, state that the results obtained go to show that an engine starting outfit will more than repay first cost in the saving of petrol effected during the first year of its use, owing to the engine being stopped instead of allowed to run while deliveries are being made. It is also claimed that it will have a marked effect on the cost of upkeep, due to the elimination of wear and tear. The company have decided to adopt an electric engine starting set as a standard part of the equipment of the Reo vehicles.

DUNLOP RUBBER COMPANY.

Mr. A. du Cros, M.P., presiding at the annual meeting of the Dunlop Rubber Company, said the total net profit of the year amounted to £435,000, from which had to be deducted the parent tyre royalty, amounting to £23,500, leaving a net balance of £411,000. This exceeded the profits of the previous year by £30,000, although the actual increase in trading profit was really £37,000, because of £7,000 odd included in the previous year in respect of premiums on shares issued. The actual sum available for distribution was £61,000 better than the previous year, the company having had to provide £31,000 last year for the expenses of new capital issues. Many exceptional charges arising directly out of the war had had to be met out of profits. The directors had to deal drastically with these, believing that this was a time for caution and conservation. The record profits had not been gained by taking advantage in any way of war conditions to increase the cost of goods. The improved profits were due, firstly, to increased output and sales in conjunction with a high standard of manufacture, and, secondly, to reduced costs, the result of improved organisation and the expenditure of capital on improved processes. He could speak particularly of a great advance in the result obtained from their solid tires. Comparing results of Dunlop solid tires sold on a mileage basis which covered nearly three hundred millions of miles, they showed steady improvement month by month. Of the profits it was proposed to divide 45 per cent., amounting to £194,000, the preference shares taking £44,800 and the balance going to the ordinary shares. If the directors' recommendation of 15 per cent. for the year were accepted, the balance of £217,000 would be either carried forward or applied in the reduction of plant and machinery, as against £171,000 last year. It had been suggested that the dividend might have been higher, but the directors thought it inadvisable at this critical period of the war. With reference to the new works, the chairman said that in the past the company had been unable to meet the demand for its productions. Government orders were very urgent, and it was partly owing to this that the buildings were undertaken. There existed also a very great demand for motor transport at home owing to the congestion on the railways. The new factory, covering seven acres, and giving facilities for further extensions, would enable them to increase the output in all departments, and in the course of time, not only to meet the demand, but increase the stock held by the company. With regard to the spinning and weaving mills specially erected near Rochdale, the chairman said the freehold site was nearly thirty acres, and the present factory nearly seven acres. When the mills were absorbed into the general business of the company a most important and substantial addition to the profits would have been made. The directors, however, attached more importance to the fact that a decided advance would have been made in the quality and durability of Dunlop tires, and it was in this direction that they hoped to reap the reward of their initiative.

The report was adopted, and the meeting agreed to increase the capital of the company to £2,000,000 by the creation of 200,000 preference shares of £1 each.

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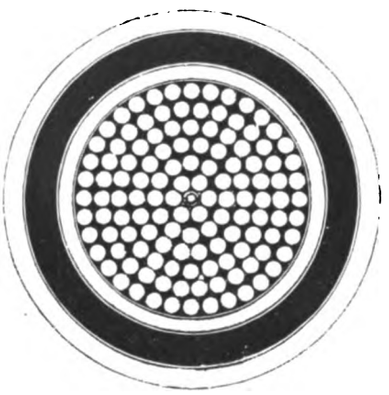

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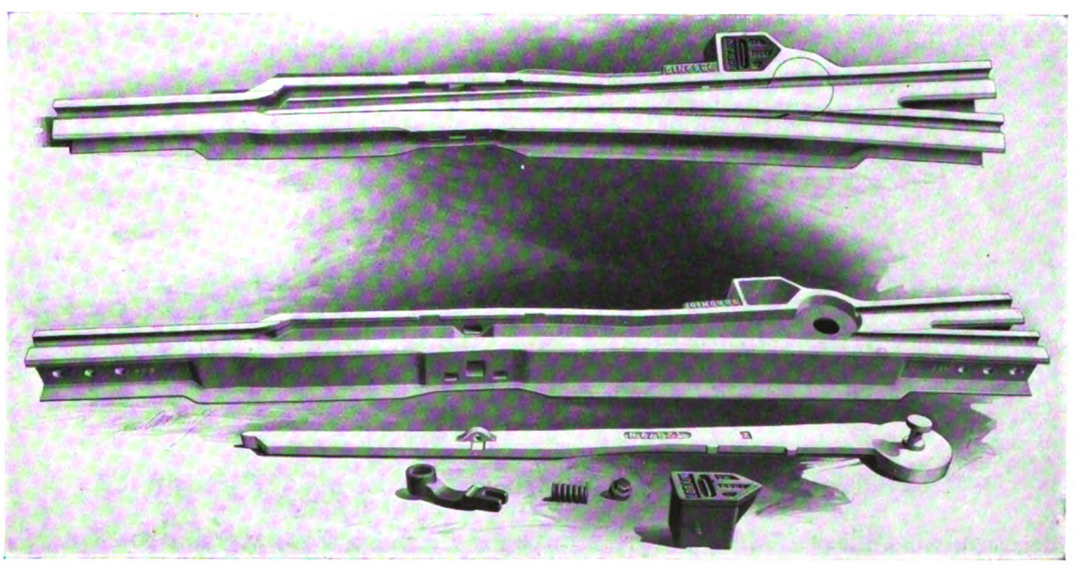

SOLID MANGANESE TADPOLE TONGUE SWITCH
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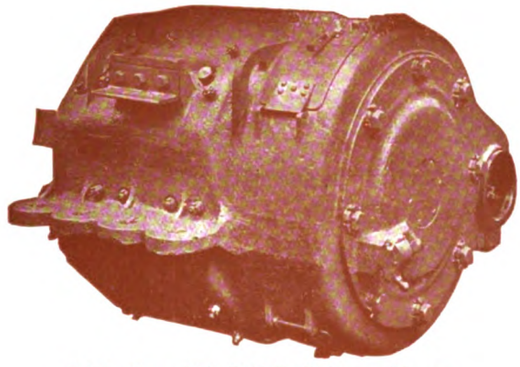
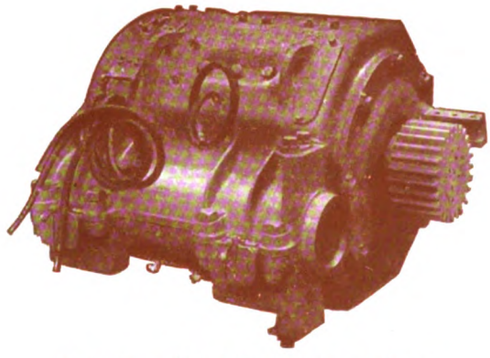


Dick, Kerr 250 B.H.P. Railway Motor, view from commutator end.



Dick, Kerr 250 B.H.P. Railway Motor, view from pinion end.

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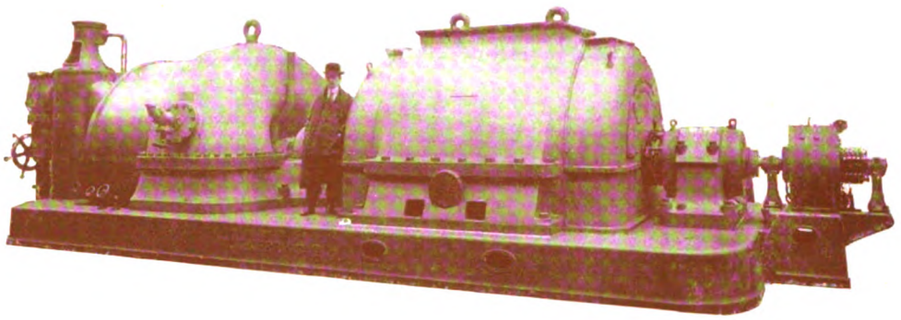

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The accident at Rotherham on January 15 is somewhat remarkable, inasmuch as it seems to have been due to the great force of the gale overpowering the car as it neared the top of a hill. The car was blown to a standstill and ran backwards down the hill. As the driver says that the controller fired, it seems that the resulting heavy current burnt some contacts there instead of opening the circuit breaker. Also the electric brake "failed to act," which may be because the driver forgot to reverse, as he should have done for the car running backwards. Another point to remember in training. Finally, the car was stopped by the hand br...

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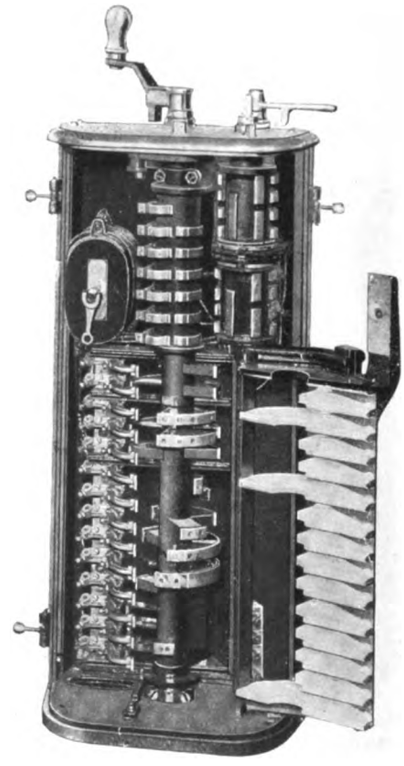

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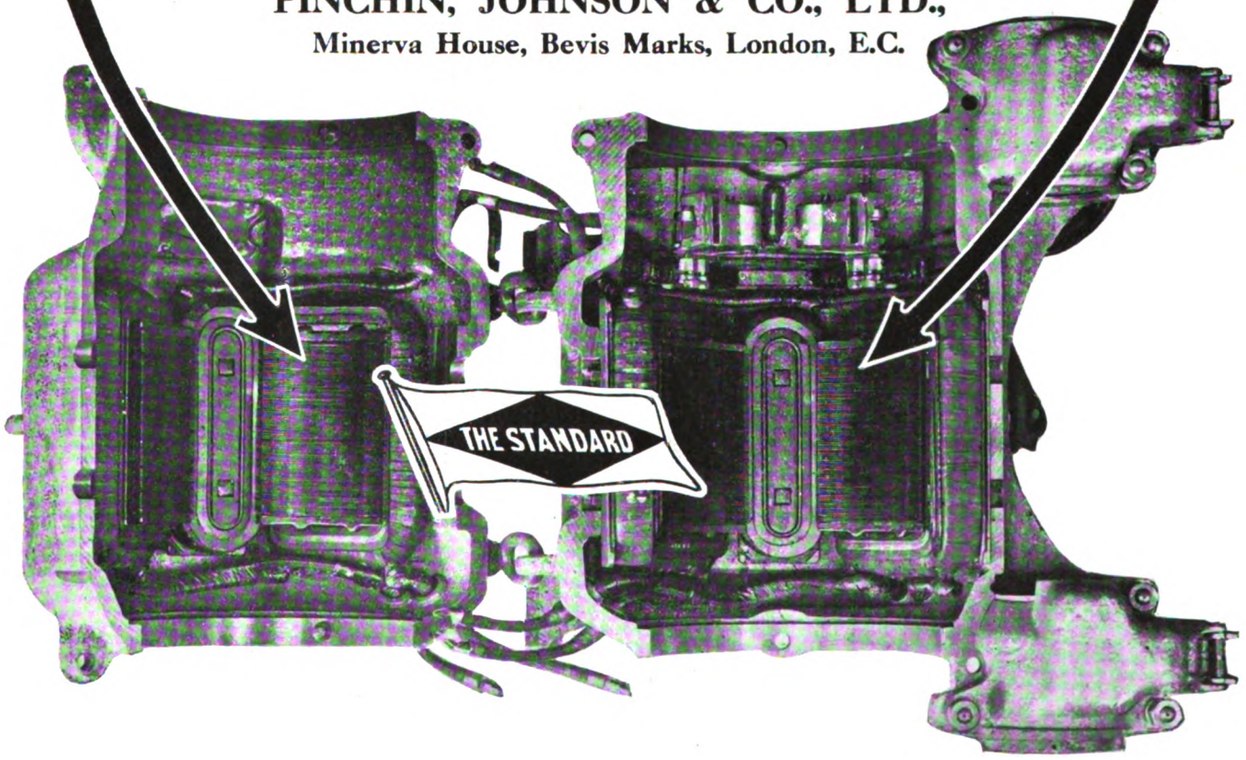

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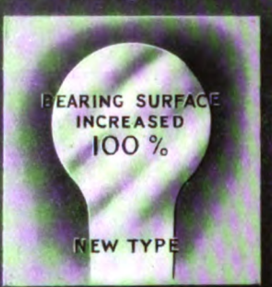

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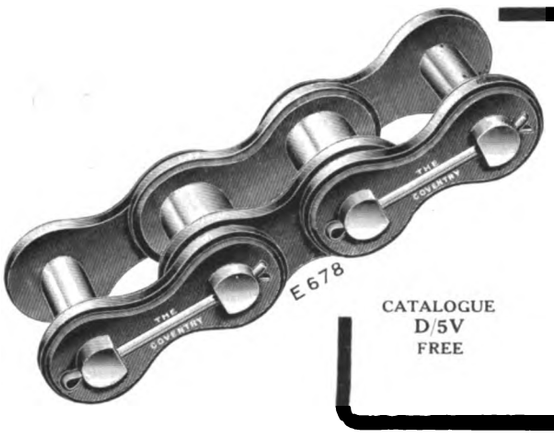

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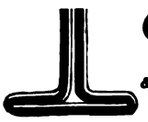

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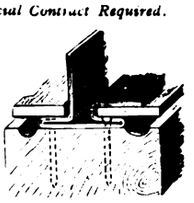

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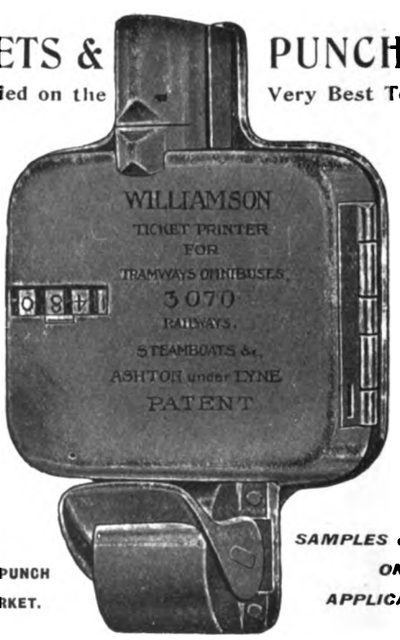

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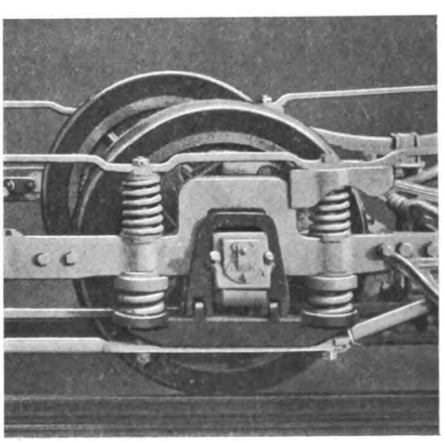

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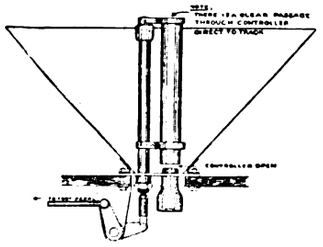

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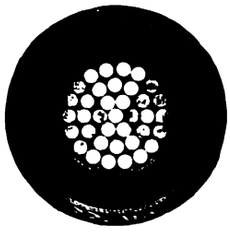

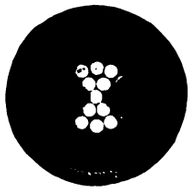

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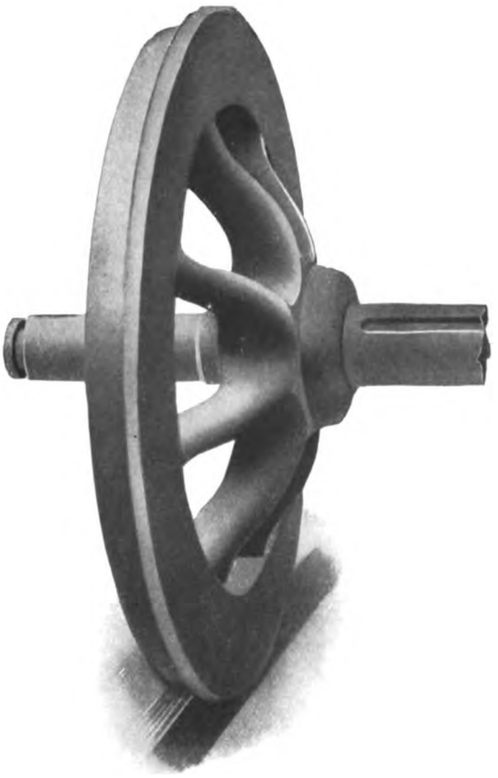

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NAMES OF PRINCIPAL OFFICERS,

POSTAL ADDRESS, TELEGRAPHIC ADDRESS, AND TELEPHONE NUMBERS.

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[Leased. See Dartford Tramways in list of Tramway Companies.]

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Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Coun. J. T. C. Salmon.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 36 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A. Fawcett.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager and Elec. Eng.*, Barnes Kay; *Per. Way Eng.*, J. S. Green (Borough Surveyor); *Chairman Try. Com.*, Coun. Waddington; *Vice-Chairman*, Coun. Haworth.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Eng. and Manager*, H. C. Dufton.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 47.] *Gen. Manager*, R. B. Leach; *Per. Way Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Coun. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

Huddersfield Corporation Tramways, Northumberland Street. Huddersfield. [T.N., 698 and 398.] *Gen. Manager & Elec. Eng.*, R. H. Wilkinson; *Assist. Engineer*, A. P. Quilliam; *Traffic Supt.*, T. Hartley; *Borough Engr.*, K. F. Campbell; *Chairman Try. Com.*, Coun. E. H. Sellers; *Vice-Chairman*, Coun. T. Canby.

Hull Corporation Tramways, Alfred Gelder Street, Hull. [T.N., 444, Corporation.] *Manager*, Wm. J. McCombe; *Elec. Eng.*, J. Wilkinson; *Per. Way Eng.*, F. W. Bricknell (*City Engineer*); *Chairman Try. Com.*, Ald. J. H. Hargreaves (Lord Mayor); *Vice-Chairman*, Coun. W. Wheatley.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager and Engineer*, L. E. Harvey; *Chairman Try. Com.*, Coun. W. J. T. Cullis; *Vice-Chairman*, Coun. Owen Waters.

Ilkeston Corporation Tramways, Park Road Ilkeston. [T.A., Bellamy Ilkeston; T.N., 26.] *Manager and Elec. Eng.*, L. C. F. Bellamy; *Acting Engineer and Manager*, G. H. Browne; *Chairman Try. Com.*, Coun. J. E. Bestwick; *Vice-Chairman*, Coun. Kane.

Ipswich Corporation Tramways, Constantine Road. Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome; *Vice-Chairman*, W. P. Burton.

Kearsley Urban District Council Tramways, Council Office. Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.

[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, South Street, Keighley. [T.A., Tramways, Keighley; T.N., 17.] *Gen. Manager and Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. A. Smith.

Kilmarnock Corporation Tramways Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, W. C. Bexon; *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com.*, Bailie Jones.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Kirkcaldy Corporation Tramways, Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson.

Leeds City Tramways, Standard Buildings, City Square, Leeds. [T.A., Tramways, Leeds; T.N., 44 and 169; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Per. Way Eng.*, R. B. Holt; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller, & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Judge Hall.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. J. A. Hennah.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Stanley Clegg, Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White; *Vice Chairman*, ———

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, C. W. Mallins; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *City Electrical Engineer*, Harold Dickinson; *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Coun. E. Russell Taylor; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 62, Finsbury Pavement, London, E.C. [T.A., Lotram, London; T.N., 3321, 3322, and 3323 London Wall.] *Chief Officer*, A. L. C. Fell; *Deputy Chief Officer*, J. K. Bruce; *Elec. Assist.*, J. Shepherd; *Traffic Assist.*, L. Slattery; *Rolling Stock Supt.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, W. J. Squires, J.P.; *Vice-Chairman*, T. Prestige.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett.

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Coun. D. T. J. Lyle; *Vice-Chairman*, Coun. Green.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Coun. F. Goodyear.

Middleton Corporation Tramways, *Consulting Engs.*, Lacey, Sillar, and Leigh; *Chairman Try. Com.*, Ald. W. Wood, J.P. (Mayor); *Vice-Chairman*, Ald. Bentley, J.P.
[Worked by Manchester Corporation Tramways.]

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. R. Mayne; *Vice-Chairman*, Coun. A. M. Sutherland.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 990 L., Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Per. Way Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways. St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis; *Vice-Chairman*, Coun. W. Beale.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain, J.P.; *Vice-Chairman*, Ald. F. R. Radford, J.P.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, ———; *Traffic Supt.*, J. Brierley; *Chairman Try. Com.*, Ald. F. G. Isherwood; *Vice-Chairman*, Coun. F. Elliot.

Perth Corporation Tramways, 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Calderwood.

Plymouth Corporation Tramways, 15, Ebrington Street, Plymouth. [T.N. 518, Plymouth.] *General Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. S. H. Phillips, J.P.; *Vice-Chairman*, Coun. J. Moon.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 83.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Inspector*, W. May; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 110 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson; *Vice-Chairman*, Ald. R. Payne.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Traffic Supt.*, C. H. Manning; *Chairman, Try. Com.*, Ald. J. Ormrod; *Vice-Chairman*, Coun. T. Parkinson.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Walker Allen, J.P.
[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81 and 85.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. J. W. Stansfield.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P. (Deputy Mayor).

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, S. S. Platt; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. Taylor.

Rotherham Corporation Tramways, Rawmarsh Road, Rotherham. [T.A., Cross, Rotherham; T.N., 138, 152, and 241.] *General Manager & Elec. Eng.*, E. Cross; *Deputy Elec. Eng.*, J. Williams; *Traffic Manager*, H. Jagger; *Per. Way Eng.*, T. P. Collinge; *Rolling Stock Supt.*, C. A. Walker; *Chairman Try. Com.*, Ald. D. L. Winter; *Vice-Chairman*, Coun. T. Reeves.

St. Helens Corporation Tramways, Town Hall, St. Helens, Lancs. *Chairman Try. Com.*, Ald. Sir J. Beecham; *Vice-Chairman*, Coun W. N. Pilkington.
[Lines worked by the New St. Helens and District Tramways Co.]

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, H. J. Hawkins; *Traffic Supt.*, W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. W. H. Barrett.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Elec. Eng.*, H. E. Yerbury; *Traffic Supt.*, A. Handford; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. Com.*, Ald. Sir W. Clegg, J.P.; *Vice-Chairman*, Coun. A. T. Bescoby, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, ; *Chairman Try. Com.*, H. Pitts.
[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, W. T. Robson; *Boro. Elec. Engineer*, H. F. Street; *Traffic Manager*, C. G. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. Daniells; *Per. Way Eng.*, E. J. Elford (*Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Ald. A. Martin.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Piermaster*, Capt. N. E. Hucker; *Chairman*, Coun. H. Dowsett.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew: *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Ald. Griffiths, J.P.; *Vice-Chairman*, Coun. Clayton.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, H. S. Ellis; *Chairman Try. Com.*, Ald. W. G. Wylie; *Vice-Chairman*, Ald. J. W. Henderson.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Coun. S. C. Homer.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Ald. Chas. Sharples; *Vice-Chairman*, Ald. W. E. Hamnett.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Chairman Try. Com.*, Coun. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker, J.P.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *Manager*, T. Medcalf; *Elec. Eng.*, A. Dimmack; *Consulting Engs.*, Lacey, Sillar, & Leigh; *Chairman Try. Com.*, Coun. A. D. Richards; *Vice-Chairman*, Coun. A. Bull.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1431, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H. Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

Walsall Corporation Tramway, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. Clarke; *Vice-Chairman*, Coun. R. J. Bishop.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Coun. Dr. G. W. Joseph; *Vice-Chairman*, Coun. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Try. Com.*, Ald. A. G. Turley, J.P. (Mayor); *Vice-Chairman*, Coun. G. Garratt.
[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 868 East.] *General Manager*, J. S. D. Moffet; *Boro' Elec. Eng.*, J. W. Beauchamp; *Chairman Try. Com.*, Ald. H. W. Littler.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Charlton.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *Gen. Manager*, F. Buckley; *Per. Way Eng.*, A. T. Gooseman; *Chairman Try. Com.*, Ald. R. T. Fletcher; *Vice-Chairman*, Coun. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. W. H. Sessions.

COMPANY TRAMWAYS.

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, W. Jackson, Dr. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *Acting Manager*, W. E. Nicoll; *Acting Sec.*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Barrow; T.N., 125.] *Manager*, W. F. Bladon; *Sec.*, T. Phillips-Conn; *Chairman*, H. S. Day; *Directors*, J. V. Kitchener, E. R. Soames.

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, Hon. Sir J. Sivewright, K.C.M.G.; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton, E. Callaird.

Bessbrook and Newry Tramway Company, Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, Robert Caven; *Elec. Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, T. McGreggor Greer.

Birmingham District Power and Traction Company (section of the Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Electrical Eng.*, S. A. Mahood; *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Blackpool and Fleetwood Tramroad Company, Ltd., Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 121.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, John Greenwood; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington, G. Richardson, G. Readman.

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Blackpool, St. Anne's, and Lytham Tramways Company, Ltd., Squires Gate, and 80, Birley Street, Blackpool. [T.N., 327 and 22]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, G. Nicholson; *Directors*, T. M. Smith, T. Preston.

Bray and Enniskerry Railway Company, 52, Westland Row, Dublin. *Sec.*, M. F. Keogh; *Chairman*, A. Killingley; *Director*, F. M'Crea.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, M. H. Volk; *Traffic Superintendent*, H. Sheppard; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Chas. Challenger; *Assist. Manager*, S. E. Smith; *Electrical Engineer*, W. H. Munton; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, Sir G. White, Bart.; *Directors*, W. G. Verdon Smith (*Managing*), S. White, J.P., J. H. Howell, J.P., G. Stanley White.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. E. Garcke (*chairman*); *Directors*, C. Shirreff B. Hilton, W. L. Madgen, J. S. Raworth, G. T. Symons, C. G. Tegetmeier, P. D. Tuckett, G. Cornwallis West; *Joint Managers*, C. H. Dade and R. J. Howley; *Acting Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.
Barnsley & District.
Barrow-in-Furness.
Birmingham & District Power & Traction Co.:
Birmingham & Midland
Dudley, Stourbridge, & District.
South Staffordshire.
Wolverhampton Dist.
Devonport & District.
Gateshead & District.
General Elec. Tramways.
Gravesend & Northfleet.
Greenock & Port Glasgow.
Jarrow & District.
Kidderminster & District.
Merthyr.
Metropolitan.
Middleton.
North Staffordshire.
Oldham, Ashton, & Hyde.
Peterborough.
Potteries.
Rothesay.
Sheerness & District.
South Metropolitan.
Southport.
Swansea.
Taunton.
Tynemouth & District.
Weston-super-Mare & District.
Worcester.
Wrexham & District.
Yorkshire (Woollen Dist.)

Burton and Ashby Light Railways, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, A. L. Charles; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Douglas Owen.

Carlisle Tramways Company, Ltd., City of, Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, R. L. McCulloch.

Chatham and District Light Railways Company, Luton Road, Chatham, and 83, Cannon Street London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Traffic Manager*, W. G. Davies; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Directors*, A. H. Beatty (*Chairman*), W. Shearer. H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C. A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, St. George's Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, W. B. H. Martindale, H. C. Levis.

Dartford Urban District Council Light Railways. Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Balfour, Beatty, & Co., Ltd., 66, Queen Street, London, E.C.) *Acting Manager*, F. A. Kincaid Fergusson.

Devonport and District Tramways Company, Tramway Depot., Milehouse, Devonport, and Electrical Federation Offices, London, W.C. [T.A., Head Office, Devonport c/o Tramway, London; T.N., Head Office, Holborn 2686. T.A., Tramways, Milehouse, Devonport; T.N., 62.] *Manager and Eng.*, George Cardwell; *Secretary*, S. M. Wright; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier.

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways, (Lessees: The National Elec. Construction Co., Ltd., 3, Laurence Pountney Hill, London, E.C.) [T.A., Overhauled, London; T.N., 5329 and 5330 Bank.] *Manager*, W. MacGibbon.

Douglas—Ramsey. (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282 and 4066 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, A. B. Coyle, J.P.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. M. Harriss; *Elec. Eng.*, H. Tannan; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, W. M. Murphy; *Directors*, W. F. Cotton, J. Mooney.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, W. G. Bond.

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 23, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, J. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager & Engineer*, Daniel Fisher; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A., Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Directors*, H. A. Stagg, C. S. B. Hilton (*deputy chairman*), L. A. Atherley-Jones, K.C., H. S. Day.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, F. J. S. Moore; *Directors*, C. M'D. Stuart, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, A. W. Bullough; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 958, Gravesend.] *Manager & Sec.*, J. R. Groves; *Chairman*, W. L. Madgen; *Directors*, P. N. Gray, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A. Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, W. F. Herring; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, E. Valied, J. B. Collings, Q. Le Pelley.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. V. Edwards; *Secretary*, W. R. Elston; *Cons. Engs.*, Kincaid, Waller, Manville, and Dawson; *Chairman*, G. Kitchen; *Directors*, E. C. Morgan, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, W. G. Verdon Smith; *Manager*, F. Freshwater; *Chairman*, Sir George White, Bart.; *Directors*, H. C. Godfray, J. H. Howell, S. White.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, ——————; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, W. M. Murphy, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *Managing Eng.*, A. Wray; *Secretary*, B. Kingsford; *Chairman*, C. S. B. Hilton; *Directors*, J. A. Lycett (*managing*), S. E. Garcke, H. S. Day.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. A. Stanley, M.P.; *Directors*, J. M. Henderson, M.P., Sir J Beecham, J.P., R. Watson, J.P., A. Adam, J. S. Austen

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, W. H. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey J. U. Hodgson, M. H. Maxwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *Gen. Manager and Eng.*, A. H. Pott; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, Sir A. H. Stanley, F. V. Schuster.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, A. E. Wray.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Mansfield & District Light Railway Co., Sutton Road, Mansfield. [T.A., Cars, Mansfield; T.N., 107.] *Gen. Manager and Sec.*, C. R. Walker; *Chairman*, A. R. Holland; *Directors*, W. I. Chadburn A. H. Beatty, G. Balfour.

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, C. A. Huni; *Chairman*, Col. Sir A. Griffith Boscawen; *Directors*, Sir W. H. Vaudrey, B. E. Greenwell, E. Schenk.

Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Traffic Supt.*, H. King; *Sec.*, S. J. Clements, *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

Metropolitan Electric Tramways, Limited, Electric Railway House, Broadway, Westminster, London, S.W. [T.A., Metrolito, London; T.N., 6800, Victoria.] Manor House Offices, Seven Sisters Road, N. [T.A., Lentiscus, London; T.N., 77 Tottenham.] *Gen. Manager and Eng.*, A. H. Pott; *Traffic Manager*, W. E. Hammond; *Secretary*, A. L. Barber; *Chairman*, E. Garcke; *Directors*, Sir E. Spencer, W. L. Madgen, C. G. Tegetmeier, J. Devonshire (*Managing Director*).

Mexborough and Swinton Tramways Company, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 3, Laurence Pountney Hill, Cannon Street, London, E.C. *Manager and Eng.*, P. Priestly; *Cons. Elec. Eng.*, F. E. Stanley; *Commercial Manager*, Wm. T. Mitchell; *Traffic Supt.*, M. McLeod; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Director* (*Managing*), W. B. Cownie, C.A.

Middlesbro, Stockton, and Thornaby Electric Tramway, Bridge Road, Stockton-on-Tees, and Clare Street House, Bristol. [T.A., Tramways, Stockton; T.N., 129.] *Manager*, F. Freshwater; *Secretary*, W. G. Verdon Smith; *Chairman*, Sir Geo. White, Bart.; *Directors*, H. C. Godfray, S. White, H. C. Doggett.

Middleton Electric Traction Company, Hiltonfold Lane, Middleton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depot, Middleton; T.N., 37 Middleton.] *Gen. Manager*, W. F Endean; *Secretary*, W. E. Woodroofe; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreathall.

Musselburgh and District Electric Light and Traction Co., Ltd., High St., Musselburgh, N.B. [T.A., Tramways, Musselburgh; T.N., 115.] (Registered Office, 3, Laurence Pountney Hill, London, E.C. [T.N., 5329 and 5330, Bank.]) *Manager*, R. Watson; *Resident Engineer*, J. L. Winter; *Traffic Inspector*, W. Scott; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, B. Burnham, J. Anderson, W. B. Cownie.

New General Traction Company, Ltd., 8, Crosby Square, London, E.C. *Managing Director*, E. A. Hopkins; *Secretary*, J. G. Mills; *Chief Engineer*, I. E. Winslow; *Chairman*, Baron E. B. d'Erlanger. [This company controls the Norwich and the Douglas Southern Electric Tramways Companies.]

New St. Helens and District Tramways Company, Ltd., Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36 Atherton.] *Engineer and Manager*, C. D. Stanley; *Secretary*, H. P. Conibear; *Chairman*, Hon. Arthur Stanley, M.P.; *Directors*, J. Hunter, J.P., H. Martin, J.P., J. M. Henderson, M.P., J. S. Austen, and E. H. Edwardes (*Managing*).

North Shields Tramway Company owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

Norwich Electric Tramway Company, 5, Orford Hill, Norwich, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, F. W. Ketley; *Consulting Eng.*, I. E. Winslow; *Sec.*, J. G. Mills; *Chairman*, Baron E. B. d'Erlanger; *Directors*, E. A. Hopkins, Hon. A. G. Brand, F. FitzGerald, G. M. Chamberlin, and C. Pakeman.

Nottinghamshire and Derbyshire Tramways Company, Tramway Depot, Langley Mill, Derbyshire, and 66, Queen Street, London, E.C. [T.A., Tramways, Langley Mill; T.N., 53, Langley Mill.] *Manager*, C. R. Walker; *Secretary*, Wm. C. Bryden; *Directors*, A. R. Holland, A. H. Beatty, A. V. Anderson, and M. A. Edwards.

Oldham, Ashton and Hyde Electric Tramway, Ltd., Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Denton; T.N., 265 Ashton.] *Supt.*, A. Anderson; *Secretary*, W. E. Woodroofe; *Chairman*, E. Garcke; *Directors*, L. A. Atherley Jones, K.C., R. Whittaker, W. S. Wreathall, J. V. Kitchener (*Managing Director.*)

Paisley District Tramways Company, Tramway Depôt, Paisley, and 83, Cannon Street, London, E.C. [T.N., 218 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Lord Arthur Butler, D. Johnston Smith, John Young.

Peterborough Electric Traction Company, Ltd., Lincoln Road, Peterborough, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Peterborough; T.N., 224.] *Gen. Manager*, T. G. Clabburn; *Secretary*, S. M. Wright; *Chairman*, Lord Vaux of Harrowden; *Director*, E. A. Paris.

Plymouth, Stonehouse and Devonport Tramways Co., 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. [T.N. 58.] *Manager*, G. H. Moreton; *Elec. Eng.*, J. Graham Pearce; *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*).

Portsdown and Horndean Light Railway, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Engineer and Manager*, J. Fereday Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern.

Potteries Electric Traction Company, Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Stoke-on-Trent; T.N., 801.] *Gen. Manager and Eng.*, W. Thom; *Power and Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, W. F. Herring; *Chairman*, G. Cornwallis-West; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

Rhondda Tramways Company, Ltd., Tramway Depot, Porth, Rhondda, and Laurence Pountney Hill, Cannon Street, London, E.C. [T.A., Tramway, Porth; T.N., 8.] *Manager and Engineer*, H. Holliday; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, H. T. Barnett.

Rothesay Tramways Company, Ltd., Point House, Rothesay, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, A. Robertson; *Elec. Eng.*, H. H. Hill; *Sec.*, W. F. Herring; *Chairman*, A. C. Miles; *Directors*, W. L. Madgen, H. S. Day.

Ryde Pier Company, Ryde, Isle of Wight. *Manager*, W. D. Stanney; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

Scarborough Tramways Company, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, J. V. Moinet; *Chairman*, F. E. Gripper; *Directors*, V. Fowler, M. T. Whittaker, J. C. Wigham.

Sheerness and District Electric Power and Traction Company, Ltd., Electricity Works, Sheerness East, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Sheerness; T.N., 45.] *Manager & Eng.*, C. W. Durnford; *Sec.*, P. N. Gray; *Chairman*, G. J. Somerville; *Directors*, R. J. Howley, E. R. Soames.

Snaefell Mountain Railway (See Manx Electric Railway Company).

South Metropolitan Electric Tramways and Lighting Company, Ltd., 114, Church Street, Croydon, 30, High Street, Sutton, and Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 304 Croydon, 14 Sutton and 6800, Victoria.] *Gen. Manager and Engineer*, A. V. Mason; *Supt.*, A. E. Wray; *Secretary*, W. M. Wright; *Chairman*, C. G. Tegetmeier; *Directors*, J. Devonshire, E. Garcke.

Southport Pier Co., Ltd., Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, W. H. Scott; *Chairman*, A. Skinner; *Directors*, I. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

Southport Tramways Company, Ltd., The Depôt. Churchtown, Southport, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, J. Lloyd; *Secretary*, H. A. Stagg; *Chairman*, C. S. Hilton; *Directors*, J. S. Raworth, Lord Vaux of Harrowden, J. V. Kitchener.

South Staffordshire Tramways (Lessee) Company, Ltd., Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, W. S. Schuster; *Directors*, J. A. Lycett, S. R. Blundstone, W. G. Bond, B. Kingsford.

Sunderland District Electric Tramways. Ltd., Fence Houses, co. Durham. [T.A., Trams, Philadelphia, Shiney Row; T.N., 21, Houghton-le-Spring.] *Resident Manager and Engineer*, G. Stratton; *Traffic Manager*, E. A. Pearman; *Secretary*, H. J. Almond; *Directors*, H. R. Hogg, Hon. R. Parker, R. Tayler.

Sutton and Howth Electric Tramway Company (owned by the Great Northern Railway, Ireland), Sutton, county Dublin, and Amiens Street Terminus, Dublin. [T.A., Railroad, Dublin; T.N., 171, Dublin. and 16 Sutton.] *Gen. Manager*, John Bagwell; *Elec. Eng.*, A. W. Whieldon; *Supt. of Line*, R. J. Moore; *Chief Eng.* F. A. Campion; *Locomotive Supt.*, G. T. Glover; *Sec.*, T. Morrison; *Chairman*, F. Vernon; *Directors*, W. P. Cairnes (*Deputy Chairman*), Sir W. Q. Ewart, Bart., W. B. Carson, H. S. Guinness, J. T. Reade, W. L. A. Goulding, Major J. C. W. Madden, R. A. Gradwell, J. Milne Barbour, T. F. Cooke, W. H. B. Moorhead, Lt.-Col. H. Plews.

Swansea Improvements and Tramways Company, 2, Rutland St., Swansea, and Electrical Federation Offices. Kingsway, London, W.C. [T.A., Tramway, Swansea; T.N., 268 Swansea.] *Gen. Manager*, D. James; *Elec. Eng.*, A. Johnston; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, G. J. Somerville, S. E. Garcke.

Taunton Electric Traction Company, Ltd., East Reach, Taunton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Taunton, c/o "Tramways," London.] *Manager*, B. H. Griffith; *Secretary*, S. M. Wright; *Chairman*, G. J. Somerville; *Directors*, E. Garcke.

Torquay Tramways Co., Ltd., St. Marychurch Road, Torquay. [T.A., Carsheds, Torquay; T.N., 167 Torquay.] *Registered Office*, 3, Laurence Pountney Hill, Cannon Street, E.C. *Manager and Eng.*, H. J. Nisbett; *Secretary*, L. D. H. Jacobs; *Managing Director*, W. B. Cownie.

Trafford Park Company (Tramways), Trafford Park, Manchester. [T.A., Developing, Manchester; T.N., 61, Trafford Park.] *Secretary*, C. A. Grundy; *Chairman*, Marshall Stevens; *Directors*, Sir J. Lyons, H. McNiel.

[Lines worked by the Manchester and Salford Corporations.]

Tynemouth and District Electric Traction Company, Limited, John Street, Cullercoats, Northumberland, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tram Co., Cullercoats; T.N., 17 Whitley.] *Gen. Manager*, H. J. Smith; *Sec.*, C. W. Francis; *Chairman*, H. S. Day; *Directors*, J. H. Robinson, J. B. Williamson, R. J. Howley Geo. J. Somerville.

Tyneside Tramways and Tramroad Company, Ltd., Neptune Bank, Wallsend. [T.A., Tramways, Wallsend; T.N., 84.] *Secretary & Res. Manager*, J. C. Little; *Elec. Eng.*, F. H. Briggs; *Cons. Eng.*, W. McLellan; *Chairman*, J. T. Merz; *Directors*, Lord Armstrong, J. H. Armstrong, G. E. Henderson, S. Hunter.

Wakefield and District Light Railway Company, Belle Isle, Wakefield.

[This company has been amalgamated with the Yorkshire (West Riding) Electric Tramways Co., Ltd.]

Walton-on-the-Naze Pier Tramway (Coast Development Corporation, Ltd.), The Pier, Walton-on-the-Naze. [T.A., Electricity Works, Walton-on-Naze.] *Eng.*, E. A. Lambert, A.M.I.E.E.; *Sec.*, J. F. Stovell.

Wemyss and District Tramways Company, Ltd., Car Depot, Aberhill, Methill, N.B. [T.A., Tramways, Methill; T.N., 38 Leven.] *Gen. Manager*, W. T. Dawson; *Sec.*, J. O. Shepherd; *Chairman*, G. Balfour; *Directors*, W. Shepherd, G. Balfour, J. H. Guild.

Weston-super-Mare and District Electric Supply Co., Ltd., Locking Road, Weston-super-Mare, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Weston-s.-Mare; T.N., 79 & 181.] *Manager and Elec. Eng.*, G. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, E. R. Soames.

Wolverhampton District Electric Tramways, Limited, Tramway Depot, Bilston, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Bilston; T.N., 56, Bilston.] *General Manager*, W. G. Bond; *Sec.*, C. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, W. G. Bond, B. Kingsford.

Worcester Electric Traction Company, Ltd., St. John's Worcester, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Worcester; T.N., 81.] *Engineering Manager*, R. Simpson; *Secretary*, C. W. Francis; *Chairman*, H. S. Day; *Directors*, J. A. Lycett, C. S. B. Hilton, S. E. Garcke.

Wrexham and District Electric Tramways Limited, 6, Lord Street, Wrexham, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Wrexham; T.N., 182, Wrexham.] *Manager*, A. A. Hawkins; *Sec.*, W. E. Bennett; *Chairman*, J. V. Kitchener; *Directors*, G. J. Somerville, W. S. Wreathall.

Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. [T.A., England, Belle Isle, Wakefield; T.N., 213.] *Gen. Manager and Sec.*, H. England; *Elec. Engs.*, C. J. Jewell and E. A. Wood; *Traffic Supt.*, W. Wilde; *Chairman*, Sir Herbert S. Leon, Bart.; *Directors*, E. Schenk, B. Newgass, G. E. Leon.

Yorkshire (Woollen District) Electric Tramways. Limited, Frost Hill, Liversedge, and Electrical Federation Offices, Kingsway, London, W.C. T.A., Tramways, Heckmondwike; T.N., 8 Heckmondwike.] *Secretary*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Sir Thos. Pilkington, E. A. Paris (*managing*).

TRAMWAY ASSOCIATIONS.

MUNICIPAL TRAMWAYS ASSOCIATION.

President:
PETER FISHER
(General Manager, Dundee Corporation Tramways).

Vice-President:
HENRY MOZLEY
(General Manager, Burnley Corporation Tramways).

Hon. Secretary and Treasurer:
C. J. SPENCER
(General Manager, Bradford Corporation Tramways), 7, Hall Ings, Bradford.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

President:
The Rt. Hon. VISCOUNT CHILSTON.

Chairman:
The Hon. ARTHUR STANLEY, M.P.

Vice-Chairman:
HARRY ENGLAND.

Hon. Solicitor: W. MORRIS, Junr. — *Hon. Auditor:* A. W. CHAMBERS, A.S.A.A.

Secretary:
A. DE TURCKHEIM.

Offices: Caxton House, Westminster, London, S.W. Telephone No. 2110 Victoria.

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LIST OF ELECTRIC TRAMWAYS & RAILWAYS.

PARTICULARS OF TRACK AND EQUIPMENT.

TRAMWAYS, pp. xxvii-xxx. RAILWAYS, p. xxx.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.*	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No of Motor Cars.	No of Dynamos	No. of Engines	Type of Engines	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS.				ft. in.	lbs.	1 in	ft. rad.						
Aberdare Urban District Trys. ..	Oct., 1913	2·9	3·3	3 6	96 G	13	45	14	2	2	V. Cp. C.	400	Lanc. Dynamo Co.
Aberdeen Corporation	Dec., 1899	14·4	27·75	4 8½	96 G	13	42·5	83	*14	14	V. Cp. C.	4,610	British T-H. Macartney & Co.
Aberdeen Suburban Trys. Co. ..	June, 1905	5	5	4 8½	95 G	28	90	9	..	..	..	..	J. G. White & Co. Brush Co.
Accrington Corporation	Aug., 1907	7	10·66	4 0	95 G	14	..	27	*8	8	..	1,888	Brush Co.
Airdrie & Coatbridge Tramway Co.	Feb., 1904	3·63	4·94	4 8½	94 G	14	210	15	..	..	..	..	Brush Co.
Ashton-under-Lyne Corporation ..	Aug., 1902	7	8·15	4 8½	96 G	10	40	25	5	5	..	400	Dick, Kerr, & Co. Siemens Bros.
Ayr Corporation	Sept., 1901	6	7·612	4 8½	90 G	21	45	24	*8	8	..	400	British T-H.
Barking Town Urban District ..	Dec., 1903	2·6	3·125	4 8½	100 G	25	44	9	4	3	V. Cp. C.	200	Blackwell & Co.
Barnsley & Dist. Elec. Traction Co.	Nov., 1902	3·06	4·25	4 8½	97 G	10	60	13	*	..	..	..	J. G. White & Co. Brush Co.
Barrow-in-Furness	Feb., 1904	5·37	8·25	4 0	90 G	13	50	16	*8	..	..	..	Brush Co. Dick, Kerr, & Co.
Bath Electric Tramways, Ltd. ..	Jan., 1904	14·7	19·3	4 8½	95 G	10·7	38	40	4	4	H.T. Cp.	675	Westinghouse
Batley Corporation	Aug., 1903	6·536	10·47	4 8½	104 G	9	40	15	6	4	H. Cp.	240	B. I. W. Co. British Elc. Cr. Co
Belfast City	Dec., 1905	49·65	98·54	4 8½	105 G	15	35	291	3	3	Tri. Exp.	3,000	J. G. White & Co. Westinghouse
Bessbrook—Newry (1) .. .. Bessbrook and Newry Trv. Co.	Oct., 1885	3	3	3 0	41 V	80	55	2 M 2 T	2	1	Hyd. Turb	..	Mather & Platt
Bexley Urban District	Oct., 1903	5·25	6·5	4 8½	90 G	14	40	21	3	3	V. Cp.	600	Dick, Kerr, & Co.
Birkenhead Corporation	Feb., 1901	13·8	24·09	4 8½	100 G	13½	40	65	6	6	V. Cp.	..	Blackwell & Co. British T-H.
Birmingham Corporation	Jan., 1904	65·56	114·55	3 6	105 G	13	40	586	..	..	..	1,475	Dick, Kerr, & Co.
Birmingham and Midland Trys. Co.	July, 1904	12·20	18·8	3 6	85 & 94 G	15	31	62	6	6	Cp.	..	Brush Co.
Blackburn Corporation	March, 1899	14·67	24·75	4 0	92 G	15	30	61	*4	4	V. Cp. C.	..	British T-H. Blackwell & Co.
Blackpool Corporation	Oct., 1885	14·75	21·38	4 8½	96 G	20	36	84	5	..	Turb.	3,250	Elwell-Parker British T-H.
Blackpool & Fleetwood Tramrd. Co.	July, 1898	7·9	15	4 8½	70 V 98 G	26	80	41	5	5	V. Cp.	600	Mather & Platt D. K. & Co.-B. T-H.
Blackpool and Fylde Light Ry. Co.	Under cons.	14	14·5	4 8½	..	..	..	..	..	..	..	..	
Blackpool—St. Anne's & Lytham ..	May, 1903	7·47	14·03	4 8½	92 G	22	35	40	..	..	..	..	British T-H.
Bolton Corporation	Nov., 1899	26	47·21	4 8½	90G	14	35	112	*12	12	V. Cp. C.	3,800	Dick, Kerr, & Co. Blackwell & Co.
Bootle Corporation	May, 1900	4·125	7·75	4 8½	95 G	20	40	55	*8	8	..	4,000	Blackwell & Co.
Bournemouth Corporation	July, 1902	21·66	31·75	3 6	100 G 66 slot	10	40	91	5	4	V. Cp.	1,200	J. G. White & Co.
Bradford Corporation	July, 1898	59	108·75	4 0	102 G	9·8	40	‡272	11	11	V. Cp. C.	..	Westinghouse Blackwell & Co.
Bray and Enniskerry Railway Co.	Under cons.	3·25	5	3 6	..	..	..	..	..	..	..	..	
Brighton Corporation	Nov., 1901	9·48	17·18	3 6	105 B.S. No. 4	9	40	53	5	5	Turb.	1,000	Macartney & Co. Westinghouse Blackwell & Co.
Brighton Beach (1)	Aug., 1883	1·75	2	2 8½	35 V	100	80	9	2	..	..	..	Siemens Bros.
Bristol—Bristol Trys. Co.	Oct., 1895	31	57·5	4 8½	92½ G	10	30	232	6	4	V. Cp. C.	..	British T-H. and Blackwell & Co.
Burnley Corporation	Dec., 1901	12·50	22·16	4 0	102 & 107 G	9·8	35	67	*8	6	H. Cp. C.	1,500	British T-H.
Burton and Ashby Light Railway..	July, 1906	10·2	12·3	3 6	90 G	11	51	20	2	2	Diesel	330	Dick, Kerr & Co. Brush Co.
Burton-on-Trent Corporation ..	Aug., 1903	6·67	9·75	3 6	90 & 100 G	11·7	40	20	3	3	V. Cp.	400	Dick, Kerr, & Co. Blackwell & Co.
Bury Corporation	June, 1903	22·5	34·42	4 8½	102¾ G	12	40	54	6	6	..	1,500	Westinghouse
Camborne and Redruth	Nov., 1902	3·75	4	3 6	83 G	15	40	8	7	7	Cp.	1,525	Dick, Kerr, & Co. British T-H.
Cardiff Corporation	May, 1902	17·25	31·82	4 8½	100 G	23	35	130	9	9	V. Cp. C. & T.	2,200	British T-H. Dick, Kerr, & Co.
Carlisle, City of, Elec. Try. Co. ..	June, 1900	7·25	8·5	3 6	83 G	14	23	15	4	4	..	..	D. K. & Co.-B. T-H.
Cavehill & Whitewell Try. Co...	Feb., 1906	3·29	4·31	4 9	105 G	31	75	10	..	..	..	..	J. G. White & Co.
Chatham & District Light Rly. Co.	June, 1902	14·98	26	3 6	92½ & 105 G	9	35	50	5	4	H. Cp.	675	British T-H. Co. Brush Co.
Cheltenham and District ..	Aug., 1901	10·22	12·25	3 6	80 & 90 G	8·9	37	20	2	2	V. Cp.	..	Westinghouse
Chester Corporation..	April, 1903	3·59	6·4	3 6	94 & 100 G	23	40	18	*7	6 1	V. Cp. C. V. Tri. Exc	240	Blackwell & Co. British T-H.
Chesterfield Corporation	Dec., 1904	3·6	5·1	4 8½	96 & 101 G	20	40	17	4	4	V. Cp. C.	800	Milnes & Co. Westinghouse Brush
Clontarf and Hill of Howth ..	July, 1900	5·5	6·5	5 3	90 & 60 G	13	34	12	..	..	..	..	W. M. Murphy & Co.
Colchester Corporation	July, 1904	6	7·94	3 6	95 G	12	43	18	8	8	V. Cp.	1,140	Dick, Kerr & Co. J. G. White & Co.
Colne Corporation Tramways ..	Nov., 1903	5·2	6·7	4 0	102 G	13	60	13	*	..	..	..	Blackwell & B. T-H. Glover & Co.
Cork Elec. Try. & Lighting Co. ..	Dec., 1898	10	15	2 11½	83 G	14	26	35	*9	9	H. Cp. C.	1,450	British T-H. Blackwell & Co.
Coventry Corporation Tramways..	Dec., 1895	12·88	15·81	3 6	65 G 81 G	16	35	51	5	3	H. & V. Cp.	700	Westinghouse Blackwell & Co.
Croydon Corporation	Sept., 1901	11·87	19·12	4 8½	96·5 G	16	40	75	*13	13	..	2,000	British T-H. Co.
Darlington Corporation	June, 1904	4·875	8·88	3 6	90 G	14	52·8	18	1	..	..	250	Westinghouse

* Current from combined lighting and traction station. (1) Third rail system. † Includes 1·25 miles railless trolley line. ‡ Includes 20 railless cars.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Dartford U. D. C.	Feb., 1906	6·5	8·5	4 8½	100 G	12	35	12	4	..	..	..	British I. W.
Darwen Corporation	Oct., 1900	4·36	7·16	4 0	95 G	9	35	19	*4	4	H. Cp.	..	British T-H.
Derby and Ashbourne	..	14·5	..	4 8½									
Derby Corporation	July, 1904	13	22·06	4 0	95 G	14	46	50	3	3	Turb.	..	J. G. White & Co. / Brush & B.T-H.
Devonport & District Try. Co., Ltd.	June, 1901	8·85	15·79	3 6	92 G	11	35	25	*	..	..	..	Blackwell & B.T-H.
Devonport Corporation	June, 1901	..	7	3 6	97 G	10	50	12	..	..	..	..	Blackwell & Co.
Doncaster Corporation	June, 1902	8·25	12·52	4 8½	94 G	16	45	32	8	8	..	1,000	Blackwell & Co.
Dover Corporation	Sept., 1897	4·75	7	3 6	87 & 90 G	10	44	24	*2	2	H.CC.	..	D. K. & B.T-H
Douglas—Port Soderick .. / Douglas Southern Elec. Trys. Co.	Aug., 1896	3·25	3·75	4 8½	65 V	12	45	8	2	2	H. Cp.	200	Westinghouse / British T-H.
Dublin & Lucan Elec. Railway Co.	March, 1900	6·5	7	3 6	50 V	20	27	9 M / 5 T	2	2	H. Cp.C.	240	Dick, Kerr, & Co.
Dublin United Tramways Co.	May, 1896	49·8	95·26	5 3	105 G	12·3	22	365	8	7	V. Cp. C.	4,300	Dick, Kerr, & Co. / Blackwell & Co. / British T-H.
Dudley and Stourbridge Trys. / British Electric Traction Co.	July, 1899	21·25	27·25	3 6	90 G	11	50	59	4	4	H. Cp.	..	British T-H. / Blackwell & Co.
Dumbarton	Feb., 1907	13	17	4 7¾	90 & 96	14	60	30	3	3	..	..	Dick, Kerr, & Co. / White & B.T-H.
Dundalk	Under cons.	6	6·25	3 6	97 G	10	50	12					
Dundee, Broughty Ferry, and District	Dec., 1905	4·125	7·25	4 8½	90 G	16·5	30½	14	3	3	V. Cp. C.	..	J. G. White & Co / British T-H. Co.
Dundee Corporation	July, 1900	16·3	30·25	4 8½	90 & 100 G	10	35	76	5	5	..	..	Blackwell & Co.
Dunfermline (Fife Try. & Power Co.)	Nov., 1909	14·6	17·4	..	90 G	10	25	28	2	2	..	..	British T-H.
East Ham Corporation	June, 1901	7·58	14·20	4 8½	90 & 105 G	25	40	45	*5	5	H. Cp.	750	Dick, Kerr, & Co.
Eccles Corporation	May, 1902	5	7·75	4 8½	100 G	..	..	..	..	..	..	..	
Edinburgh and District	June, 1910	1·25	1·5	4 8½	100 G	21	54	4	..	..	..	..	Dick, Kerr, & Co.
Erith Urban District Council	Aug., 1905	4·7	8·4	4 8½	100 G	17	40	17	3	5	..	..	Brush Co. / WestinghouseCo.
Exeter Corporation	April, 1905	4·875	7	3 6	90 G	11·5	35	24	*4	4	H. Cp.	..	Dick, Kerr, & Co
Falkirk and District	Oct. 1905	7·81	10·5	4 0	90 G.	11·3	48	18	*	..	..	..	Bruce Peebles & Co. / British T-H.
Farnworth Urban District	Jan., 1902	4·33	7·16	4 8½	98 G	29	36	13	4	4	..	..	
Felixstowe Pier	Aug., 1905	0·5	0·5	3 6	36	..	..	3	..	..	..	..	
Gateshead and District	May, 1901	11·25	17·30	4 8½	90 G	8	35	53	*	..	..	..	Dick, Kerr, & Co / Blackwell & Co.
Giant's Causeway Elec. Try. Co.	Sept., 1883	8	9	3 0	42 V / 75 G	24	30	5 M / 21 T	2	2	Hyd. Turb.	..	Siemens Bros. / British T-H.
Glasgow Corporation	Oct., 1898	99·26	198·13	4 7¾	110 G	11·93	30¾	857	8	8	V. Cp. & T	21,700	British T-H. / Westinghouse
Glossop Urban District	Aug., 1903	4·56	5·6	4 8½	90 G	13	40	8	4	4	V. Cp.	200	British T-H
Gloucester Corporation Light Rly.	May, 1904	9	15	3 6	90 G	25	40	30	*2	2	Cp.	750	Brush Co. / Dick, Kerr, & Co
Gosport & Fareham Trys. Co.	Jan., 1906	7·5	11·5	4 7¾	96 G	16	37½	22	3	3	V. Cp. C.	750	Dick, Kerr, & Co. / Brush Co.
Gravesend and Northfleet	Aug., 1902	6 5	9	4 8½	87 G	11	45	18	*				
Great Crosby	June, 1900	2·5	2·5	4 8½	92½ G	..	40	14	*7	7	H. & V. Cp.	160	Dick, Kerr, & Co. / Blackwell & Co.
Great Grimsby	Dec., 1901	6	11	4 8½	90 G	15	26	32 M / 6 T	3	3	..	400	Dick, Kerr, & Co.
Greenock and Port Glasgow	Oct., 1901	7·425	14·05	4 7¾	90 G	11	60	42	*				
Guernsey Railway Co.	Nov., 1892	3	3	4 8½	74 V / 84 G	60	60	9 M / 8 T	2	1	H. & V. Cp.	160	Siemens Bros. / British T-H.
Halifax Corporation	June, 1898	37·53	55·5	3 6	95½ G	9·5	38·6	101	*7	7	H. & V. Cp. & T.	3 000	Electric Cons. Co / British T-H.
Hampshire Light Railway (Elec.) Co.	March, 1903	6	9	4 8½	..		..	10	*				
Hartlepool Electric Tramways Co.	May, 1896	6·72	8·3	3 6	87 & 90 G	15	35	21	4	4	V. Cp.	..	Electric Cons. Co. / Dick, Kerr, & Co.
Haslingden Corporation	July, 1908	3	3	4 0	100 G	10	30	..	..	..	..	45	Dick, Kerr, & Co.
Hastings and District	July, 1905	19·33	34	3 6	90 G	8	36·75	65	6	6	V. Cp.	2,100	Dick, Kerr, & Co.
Herne Bay Pier (1)	March, 1899	·75	·75	3 0	60	..	..	3	1	1	Gas	50	British T-H.
Heywood Corporation	Dec., 1905	4·25	4·25	4 8½	90 G	17	..	..	1	1	..	300	Blackwell & Co. / B.I. & H.C. Co.
Houghton-le-Spring (See Sunderland Dist. Elec. Trys.)													
Huddersfield Corporation	Feb., 1901	34·50	56	4 7¾	98 G	11	35	106	4	4	V. Cp. C.	2,200	British T-H.
Hull Corporation	July, 1899	13·46	30·5	4 8½	94 G	20	30	180	7	7	V. Cp. C.	2,560	British T-H. / Westinghouse
Ilford Urban District	Mar., 1903	7·42	12·62	4 8½	95 G	13	33·3	28	*7	7	..	1,600	British T-H. / Dick, Kerr, & Co.
Ilkeston Corporation	May, 1903	3·8	4·3	3 6	90 G	12	28	13	..	..	..	..	Dick, Kerr, & Co.
Ipswich Corporation	Nov., 1903	10·8	14·87	3 6	90 G	11·5	40	36	*10	10	Enclos'd	1,175	Westinghouse
Isle of Man—													
Manx Elc. Rly. Co. Douglas to Ramsey	July, 1893	18	35·75	3 0	62½ V	24	90	65	9	9	H. Cp.	1 300	Mather & Platt
Snaefell Mountain	Aug., 1895	4·5	9·5	3 6	56 V	12	90						
Isle of Thanet Trys. & Ltg. Co.	April, 1901	11	20·67	3 6	90 & 100 G	11	38	59	*6	6	3 V. Cp. / 3 H. Cp.	800	British T-H. / Blackwell & Co.
Jarrow and District	Nov., 1906	2·54	3·42	4 8½	95 G	12·5	50	10	..	..	..	..	Brush Co. / B.I. & H.C. Co.
Kearsley Urban District	Jan., 1902	1·75	1·75	4 8½	95 G	20	..	..	..	..	..	..	Westinghouse
Keighley Corporation	Oct., 1904	3·5	6·11	4 0	95 G	25	60	12	*4	4	V.	200	Blackwell & Co. / Brush & B.T-H.
Kidderminster—Stourport / British Electric Traction Co.	May, 1898	4·6	4·87	3 6	75 G	14	45	13	*5	5	Stm. Turb.	..	Brush Elc. Eg. Co
Kilmarnock Corporation	Dec., 1904	4·18	5·5	4 8½	90 G	24	45	14	*3	3	..	250	Blackwell & Co.
King's Norton & Northfield U. D.	May, 1904	5·25	8·25	3 6	105 G	15&21	100&145	..	..	..	..	..	Blackwell & Co
Kinver	April, 1901	4	4	3 6	63 & 90 G	..	..	6					
Kirkcaldy Corporation	Feb., 1903	6·11	8·56	3 6	100 G	11	40	26	*10	6	Cp. H.T.	2,290	British T-H. Co
Lanarkshire Tramway Co.	July, 1903	28·431	43·120	4 7¾	96 & 101 G	9·4	37	76	4	4	3 H. Cp. / 1 V. Cp.	825	British T-H. Co
Lancashire United Tramways Co.	Oct., 1902	39	54	4 8½	90 G	15	50	82	*5	5	V. Cp. C.	2,750	B. I. W. Co.
Lancaster Corporation	Jan., 1903	4	4·81	4 8½	90 G	8	30	12	4	4	V. Cp.	200	Greenwood & Batley, Ltd.
Leamington & Warwick Elec. T. Co.	July, 1905	3·04	6·1	3 6	65 G	12	47	12	3	3	Cp.	..	Brush Co.
Leeds City	Aug., 1897	69·02	114·62	4 8½	105 & 111 G	8·4	32	345	5 / 3	5 / 3	H. Cp C. / Stm. Tur	6,150	Elec. Con. Co. / Greenwood & Batley, British T-H. / Blackwell & Co.

* Current from combined lighting and traction station. (1) Third Rail system. M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines.	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Leicester Corporation	May, 1904	20	37	4 8½	100 G	16	35	160	4	4	V. Cp.C.	2,500	Dick, Kerr, & Co, Blackwell & Co
Leith Corporation	Aug., 1905	9·08	17·9	4 8½	106·7 G	19	54	37	*11	11	..	1,600	Brush & B.T-H.
Leyton Urban District	Dec., 1906	9·125	18·5	4 8½	105 & 111 G	24	45	60	*8	8	Cp.	1,600	..
Lincoln Corporation (1)	Nov., 1905	1·75	2·96	4 8½	100 G	..	..	8	*8	8	..	645	Blackwell & Co.
Liverpool Corporation	Nov., 1898	70	127	4 8½	95, 123 & 134 G	13	30	599	*42	42	Trip. Ex.	44,600	British T-H. Dick, Kerr, & Co. Westinghouse
Liverpool Overh'd Ry. (Trol. Ln. Ex.)	June, 1900	2·5	2·5	4 8½	92½ G	Nil	40	14	7	7	H. & V. Cp.	160	Dick, Kerr, & Co.
Llandudno and Colwyn Bay ..	Oct., 1907	6·60	7·573	3 6	90 G	11·5	45	18	*	..	..	..	Bruce Peebles & Co.
Llanelly and District	July, 1911	6·25	6·75	4 8½	90 G	..	..	10	*2	2	Trip. Ex.	..	British T-H.
London County Council (2) ..	May, 1903	142·98	279·3	4 8½	105 G	11	45	1730	..	..	V. Cp. C. Turbine	..	Dick, Kerr, & Co. Westinghouse
London United Tramways Co. ..	April, 1901	55·25	102·45	4 8½	92½ & 100 G	18	28	339	7	5	V. Cp.	3,500	British T-H. Westinghouse. Blackwell & Co.
Lowestoft Corporation	July, 1903	4·75	5·07	3 6	100 G	27	36	19	*5	5	Cp.	..	Blackwell & Co.
Luton Corporation Tramways .. (Leased to J. G. White & Co., Ltd.)	Feb., 1908	5·25	6·25	4 8½	95 G	11	35	12	*1	1	..	..	J. G. White & Co. British T-H.
Maidstone Corporation	July, 1904	5·5	7·04	3 6½	96 G	9	35	19	6	6	..	300	Dick, Kerr & Co
Manchester Corporation	June, 1901	120·05	244	4 8½	105 G	14·9	35	685	*22	22	Turb'nes	45,300	British T-H. Dick, Kerr, & Co
Mansfield and District Co. ..	July, 1905	10	12·25	4 8½	90 G	17	50	20	*3	3	..	..	
Merthyr	April, 1901	2·98	3·94	3 6	96 G	11	66	16	*4	4	H.S.V.	..	D. K. & B. T-H
Metropolitan Electric Trys., Ltd.	July, 1904	52·5	105	4 8½	100 G	12	40	312	5	5	1 Stm. Tur	..	British T-H. Brush Co.
Mexborough & Swinton Trys. Co.	Feb., 1907	7·75	10·75	4 8½	90 G	8·5	55	20	3	3	..	1,300	Brush & B.T-H.
Middlesbro', Stockton, & Thornaby Electric Tramways Co.	July, 1898	10·5	15·825	3 6	92½ G	17	35	60	3	4	H. & V. Cp.	900	British T-H. Blackwell & Co.
Middlesex County Council	Aug., 1904	25·5	51	4 8½	..	..	..	..	..	..	..	..	
Middleton Corporation	March, 1902	2·5	5	4 8½	..	..	..	..	..	..	..	..	
Middleton Electric Traction Co. ..	March, 1902	8·5	10·53	4 8½	90 G	15	49½	28	3	3	..	500	Glover & Co.
Musselburgh and District ..	Dec., 1904	6·5	8·125	4 8½	90 G	34	45	16	4	3	..	400	B. T-H. Co., Nat. Elec. Cons. Co
Nelson Corporation	Feb., 1903	2·74	3·86	4 0	106 G	11	41	11	*4	4	..	400	Blackwell & Co. British T-H. Co. Brush Co.
New St. Helens & District Trys. Co.	July, 1899	18	20	4 8½	95 G	13	35	36	*4	4	V. Cp. C.	..	Westinghouse British T-H.
Newcastle Corporation	Dec., 1901	31·25	61	4 8½	101 G	11	35	223	5	5	V. Cp.	..	Westinghouse British T-H
Newport (Mon.) Corporation ..	April, 1903	7·5	14·35	4 8½	98 G	10·5	40	44	5	5	V. Cp.	1,750	Westinghouse
Northampton Corporation	July, 1904	6·5	11·16	3 6	90 & 96 G	18	50	33	4	4	V. C. C. & T	1,020	Dick, Kerr, & Co. Brush Co.
North Shields Tramways Co. ..	March, 1901	..	7·75	3 6	90 G	10	36	22					
North Staff. Trys. (*vide* Potteries)													
Norwich Electric Tramways Co. ..	July, 1900	14·5	19·25	3 6	65½ & 90 G	12·6	38	52	4	4	H. T. Cp.	800	Westinghouse Blackwell & Co.
Nottingham Corporation	Jan., 1901	21·5	41·5	4 8½	107 G	11·5	40	155	*3	3	..	..	British T-H. Dick, Kerr, & Co.
Nottinghamshire & Derbyshire Tramways Co.	Aug., 1913	12·8	16·10	4 8½	G	..	..	24	*	..	..	..	British T-H.
Oldham, Ashton & Hyde Trys. Co.	June, 1899	8·888	11·183	4 8½	97 G	11	28	46	*3	3	V. Cp. C.	..	British T-H.
Oldham Corporation	Dec., 1900	24	37	4 8½	100 & 105 G	10·5	40	109	*4	4	..	2,220	Dick, Kerr, & Co.
Paisley & District Tramways Co.	June, 1904	15	25	4 7½	90 G	10	34	58	..	..	..	..	British T-H.
Perth Corporation	Oct., 1905	4·846	6·75	3 6	90 G	16	25	12	5	5	Cp.	500	Blackwell & Co.
Peterborough Elec. Traction Co. ..	Jan., 1903	5·33	6·71	3 6	94 G	31	35	14	..	..	..	..	Blackwell & Co. Dick, Kerr, & Co
Plymouth Corporation	Sept., 1899	7·75	15	3 6	92 G	9	35	42	3	3	V. Cp.	..	Elec. Cons. Co Westinghouse
Plymouth, Stonehouse, and Devonport	Nov., 1901	1·5	3·62	3 6	84 G	11	34	14	..	..	..	..	Blackwell & Co. Dick, Kerr, & Co
Pontypridd Urban District ..	March, 1905	5·5	8·6	3 6	96 & 100 G	10	27·6	26	4	5	V. C. Cp.	450	B. I. W. & B.T-H. Blackwell & Co.
Portmadoc & South Snowdon Rly.	Under cons.	13·25	15	1 11½	41	28	200	6	..	..	..	..	
Portsdown & Horndean Tramway	March, 1903	6	7·5	4 7¾	96 G	16	40	16	2	2	Oil	200	Dick, Kerr, & Co Brush Co.
Portsmouth Corporation	Sept., 1901	17·65	34·63	4 7¾	96 & 100 G	17	35	100	5	4	V. & H. Cp.	2,075	Macartney & Co. Dick, Kerr, & Co.
Potteries Electric Traction Co. ..	May, 1899	31·67	41·48	4 0	87, 90, 100, & 110 G	11	45	110	8	8	H. Cp. V. Cp.	2,275	Dick, Kerr, & Co. Blackwell & B.T-H.
Preston Corporation	June, 1904	10·54	17·2	4 8½	B.S.S. No. 2	16	28	39	2	2	H. Cp.	600	Dick, Kerr, & Co.
Radcliffe Urban District ..	April, 1905	5	6·5	4 8½	100 G	15	40	..	*4	4	V. Cp.	600	Mather & Platt
Rawtenstall Corporation	May, 1909	12	15·9	4 0	100 G	15	38	24	*3	3	..	850	Westinghouse
Reading Corporation	July, 1903	7·44	13·175	4 0	96 G	16	35	36	4	4	V. Cp.	400	Blackwell & Co. Dick, Kerr, & Co Westinghouse
Rhondda Tramways Co.	July, 1908	17·5	24·5	3 6	95 G	15	45	50	8	4	..	1,400	British T-H. Brush
Rochdale Corporation	May, 1902	19·58 (A)	22·74 (A)	4 8½	103½ G	11·7	30	69	..	..	..	..	British T-H. Dick, Kerr, & Co Brush Co.
Rotherham Corporation	Jan., 1903	10	12	4 8½	100 G	9·5	45	36	*6	6	H. S. Cp.	1,485	Dick, Kerr, & Co.
Rothesay	June, 1902	4·81	9·68	3 6	94 G, 77 G	24	34	20	3	3	V. & Oil	350	Dick, Kerr, & Co
Ryde Pier, Isle of Wight Ryde Pier Co. (3) ..	March, 1886	5	1	4 8½	30 & 34 V	..	..	4	2	2	Gas	..	Westinghouse Siemens Bros.
Salford Corporation	Oct., 1901	41·25	75·79	4 8½	103 G	20	47	200	*8	9	V. Cp. C.	2,400	Westinghouse Mather & Platt
Scarborough Tramways Co. ..	May 1904	5	7·75	3 6	90 G	10·5	35	22	2	2	Stm. Turb.	..	Brush & B.T-H.
Sheerness and District	April, 1903	2·5	2·704	3 6	94 G	43	40	8	6	5	V. Cp. C.	100	Siemens & Halske Brush Co.
Sheffield Corporation	Sept., 1899	40	77·84	4 8½	110 & 116 G	9·5	35	339	7	7	1 H. Cp. 6 V. Cp.	5,725	British T-H

* Current from combined lighting and traction station. (1) G.B. surface contact system. (2) Mainly Conduit system, but there are now several Trolley lines. Besides the electric lines the London County Council has also 4·45 route miles of horse tramways. (3) Third rail system. (A) Not including 17·1 miles track leased.

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ELECTRIC TRAMWAYS (contd.).	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge. ft.	Gauge. in.	Weight and Type of Rail lbs.	Maximum Gradient. 1 in	Sharpest Curve. ft. rad.	No. of Motor Cars.	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, Kw.	Principal Contractors for Electrical Equipment
Shipley Urban District	May, 1902	6	10	4	0	98 G	15	..	..	4	3	..	..	British T-H.
Soothill Nether U.D.C. & Dewsbury & Ossett Corporations	Nov., 1908	3·125	4·45	4	8½	90 G	13	50	8	*	..	..	..	Nat. Elec. Cons. Co.
Southampton Corporation	Jan., 1899	10·25	18·75	4	8½	{96 G & 105 (B.S. No. 4)}	13	40	73	6	6	H. Cp. C.	1,000	Westinghouse
Southend Corporation	July, 1901	7·01	13·52	3	6	90 G	18	48	42	*6	7	V. Cp.	2,075	British T-H.
Southend Pier (1) Southend Corp.	Aug., 1890	1·25	1·25	3	6	60 G	Lev.	..	25	..	..	..	..	British T-H.
South Metropolitan Elec. Try. Co.	Feb., 1906	13·09	26	4	8½	95 G	16	42	51	*8	6	Stm Tbs	1,650	{Dick, Kerr & Co. Brush Co.
Southport Corporation (5)	July, 1900	13·5	10·75	4	8½	87 & 90 G	25	45	30	*3	3	H. Cp.	600	Dick, Kerr, & Co.
Southport Electric Tramway Co.	July, 1901	8·17	12·52	4	8½	87 G	Nil	40	21	*				
Southport Pier	1905	1	1	4	0	..	..	..	3	..	..	..	..	Westinghouse
South Shields Corporation	March, 1906	5·7	10·25	4	8½	95 G	15	35	40	2	2	V. Cp. C.	1,100	Dick, Kerr & Co.
South Staffordshire	Jan., 1893	18·98	29·5	3	6	97 & 90 G	17	46	46	3	3	C.H. Cp.	..	{Blackwell & Co. E. C. C.
Stalybridge, Hyde, Mossley, and Dukinfield	May, 1904	23·75	27·75	4	8½	99 G	9	27½	60	9	{3 Marine 2 Stm. tur		7,900	Dick, Kerr, & Co.
Stockport Corporation	Aug., 1901	16	27·62	4	8½	96 G	10·8	35	50	*5	5	Cp.	1,000	Dick, Kerr, & Co.
Sunderland Corporation	Aug., 1900	10·92	20·35	4	8½	96 G	12	36	70	*	..	..	936	Dick, Kerr, & Co.
Sunderland District Electric Trys.	June, 1905	14·27	15·97	4	8½	90 G	11	40	33	*	..	..	..	British T-H.
Sutton & Howth (G.N.R., Ireland)	June, 1901	5·3	6	5	3	72 B	16·7	300	11	3	3	V. Cp.	500	{British T-H. Westinghouse
Swansea Tramways Company	June, 1960	12·43	18·54	4	8½	84 & 86 G	14	45	65	3	3	H. Cp. C.	620	British T-H.
Swindon Corporation	Sept., 1904	3·7	4·4	3	6	105 G	14	37	12	5	4	..	600	Dick, Kerr & Co.
Taunton Electric Traction Co.	Aug., 1901	1·66	2	3	6	90 G	25	35	6	*	..	..	..	Blackwell & Co.
Torquay Tramways	April, 1907	6·95	11·125	3	6	90 G	12	45	18	*2	1	..	..	British T-H.
Trafford Park Estates, Ltd. (Trys.)	July, 1903	2·5	2·75	4	8½	100 G	Nil	35	7	4	4	Tand Cp.	..	Westinghouse
Tynemouth and District	March, 1901	4·21	7·83	3	6	90 G	10	30	21	*3	3	..	..	Blackwell & B.T-H.
Tyneside Tramways & Tramroads Co.	Sept., 1902	10·97	16·23	4	8½	95 G	10	40	24	*				
Wakefield & District Lgt. Rlys. Co.	Aug., 1904	24·69	40·382	4	8½	96 G	15·5	40	69	5	5	..	1,200	Dick, Kerr, & Co.
Wallasey Corporation	March, 1902	12	20	4	8½	98 G	11	40	67	*1	1	Turbine	1,000	Blackwell & Co.
Walsall Corporation	Jan., 1904	13·5	19·5	3	6	90 & 92 G	18·5	32	39	*7	7	V & Tur.	2,490	{British T-H. Electric Cons. Co.
Walthamstow U.D.C. Light Rly.	June, 1905	9·14	12·53	4	8½	100 G	18	40	38	*15	12	{Gas & Turb's}	1,560	Westinghouse
Walton-on-Naze Pier	Aug., 1898	·5	·5	3	6	36 V	..	..	3	3	2	..	100	{Blackwell & Co. British T-H.
Warrington Corporation	April, 1902	6·5	9·6	4	8½	90 G	27	50	21	*6	6	V. C.	500	
Wemyss and District	Aug., 1906	7·5	9	3	6	{95 & 97 G}	18	85	17	3	3	2 V. Cp.	..	Bruce Peebles & Co
West Bromwich Corporation	Dec., 1902	7	12·5	3	6	98 G	20	49	29	8	8	Turb'nes	750	{Dick, Kerr, & Co. B. I. W. Co.
West Ham Corporation	Feb., 1904	16·8	30·0	4	8½	100 G	18	40	118	*3	3	V. C. Cp.	1,500	Brush & B.T-H.
Weston-super-Mare	May, 1902	2·39	3·5	4	8½	90 G	25	40	12	5	4	Cp.	..	{Blackwell & Co. British T-H. Brush Co.
Wigan Corporation	Jan., 1901	30·9	45·42	{3 6 4 8½}		105 G	12	45	73	*8	8	..	740	Blackwell & Co.
Wolverhampton Corporation (3)	April, 1902	13·5	22	3	6	91 G	15	37·5	52	*10	10	{H. & V.C. & Turb's}	2,900	{British T-H. Electric Cons. Co.
Wolverhampton District	April, 1900	14·75	19	3	6	90 G	20	40	30	*4	..	..	..	{B.I.W. & B.T-H. Westinghouse
Worcester Electric Traction Co.	Feb., 1904	5·86	8·58	3	6	94 G	13	45	15	*3	3	..	..	{Brush Co. Dick, Kerr, & Co.
Wrexham and District	April, 1903	4·44	6·16	3	6	96 G	9·11	50	10	*6	..	..	..	British T-H.
Yarmouth Corporation	June, 1902	10	14·4	3	6	90 & 95 G	27	48	35	3	3	Comp.	..	{Brush Co. B.I.W. Co.
York Corporation	Jan., 1910	6	9·9	3	6	100	18	40	37 M. 4 T.	*8	8	V. C.	..	{Dick, Kerr, & Co. Brush & B.T-H.
Yorkshire Woollen District	Feb., 1903	22·25	36	4	8½	{94 & 100 G}	8	30	69	*	..	..	..	{Brush Co. Dick, Kerr, & Co.
RAILWAYS.														
LONDON AND VICINITY:														
Central London Rly. Co. (1)	July, 1900	6·5	13	4	8½	100 V	30	..	68 M. 172 T.	6	6	H. Cp. C.	..	British T-H
City & South London Rly. Co. (1)	Dec., 1890	7·25	14·75	4	8½	{60 V 80 V}	30	120	52 L. 142 T.	(a)	..	..	..	{Mather & Platt. Elec. Cons. Co
East London Railway (2)	April, 1913	5·75	11·5	4	8½	90 B	..	..	(c)	..	..	..	..	British T-H.
Gt. Northern & City Rly. Co. (2)	Feb., 1904	3·5	7·75	4	8½	85 V	52	660	85 M 40 T	6	..	..	..	British T-H.
Great Western Railway (Hammersmith and City line.)	Nov., 1906	4·9	10·5	4	8½	97½ B	60	400	48 M. 80 T.	10	10	V. Cp.	..	{British T-H. Elec. Con. Co.
London & North Western Rly. (Euston-Watford line in progress) (2)	May, 1914	41·5	80	4	8½	..	..	..	..	..	..	Turbine	..	{Siemens Works Westinghouse
London & South Western Rly. (Extensions in progress) (1)	Under cons.	47	150	4	8½	..	..	168	84	..	..	Turbine	..	{Dick, Kerr & Co. British T-H Westinghouse
London, Brighton, and South Coast Railway (4) (Extensions in progress)	Dec., 1909	22	70	4	8½	..	..	..	16 M. 8 T.	*(d)	..	..	..	{British T-H. Blackwell & Co.
London Electric Railway Co.: Baker St. & Waterloo Ry. (2)	March, 1906	7	14·0	4	8½	90 B	60	330	86 M. 72 T.	(a)	..	..	..	{Westinghouse British T-H.
Charing Cross—Hampstead Railway (2)	June, 1907	8	16·5	4	8½	90 B	33	330	60 M. 90 T.	(a)	..	..	..	{Westinghouse British T-H.
Great Northern, Piccadilly & Brompton Rly. (2)	Dec., 1906	9·25	18·5	4	8½	90 B	33	330	72 M. 144 T.	(a)	..	..	..	{Westinghouse British T-H.
Metropolitan Railway (2)	Jan., 1905	26	59	4	8½	86 B	44	363	86 M. 172 T.	4	4	Turbine	..	{Westinghouse British T-H.
Metropolitan District Railway (and running powers) (2)	July, 1905	41	80·46	4	8½	86 B	40	330	284 M. 286 T.	(a)	..	Turbine	..	{British T-H. Westinghouse
Waterloo and City Rly. (1)	Aug., 1898	1·5	3	4	8½	87 B	30	321	17 M. 12 T.	6	6	V. C.	..	{Siemens Bros. Dick, Kerr & Co.
PROVINCES:														
Lancashire and Yorkshire (2) (Extensions in progress)	March, 1904	43	85	4	8½	86 B	85	840	88 M. 52 T.	6	5	{1 V.C. 4 H.C.}	..	Dick, Kerr, & Co.
Liverpool Overhead Rly. Co. (1)	March, 1893	6·5	13·05	4	8½	60 V	40	429	46 M. 7 T.	7	7	{H.Cp. V.Cp.}	..	{Electric Cons. Co. Dick, Kerr, & Co.
Mersey Railway (1)	April, 1903	4·5	9	4	8½	86 B	27	528	24 M. 87 T.	5	5	V. Cp.	..	{Westinghouse Elec. & Mfg. Co
Midland Rly.—Morecambe and Heysham Branch (4)	June, 1908	9·75	19·5	4	8½	..	..	..	8 M. 6 T.	4	4	Gas.	..	{Westinghouse Siemens Bros.
North Eastern Railway (1)	March, 1904	35	80	4	8½	90 B	55	792	60 M. 50 T.	(b)	..	..	..	British T-H. Co.

* Power from combined lighting and power station. (1) Third rail system. (2) Third and fourth rails system. (3) Lorain surface contact system. (4) Single phase.
(5) Not including 9 miles owned but leased. (a) Power supplied by Chelsea Power Station (80,000 H.P.) (b) Power purchased from the Newcastle-upon-Tyne Electric Supply Company, Limited. (c) Rolling stock supplied by Metropolitan Railway. (d) Power supplied by London Electric Supply Corporation.
M—Motor Cars. T—Trail Cars.

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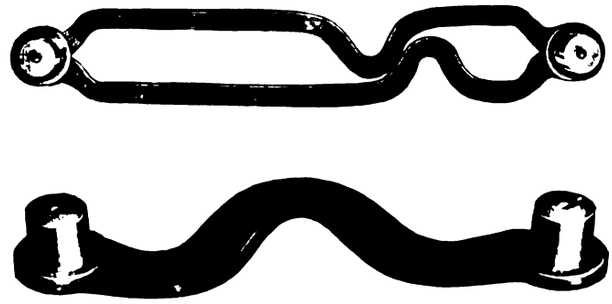

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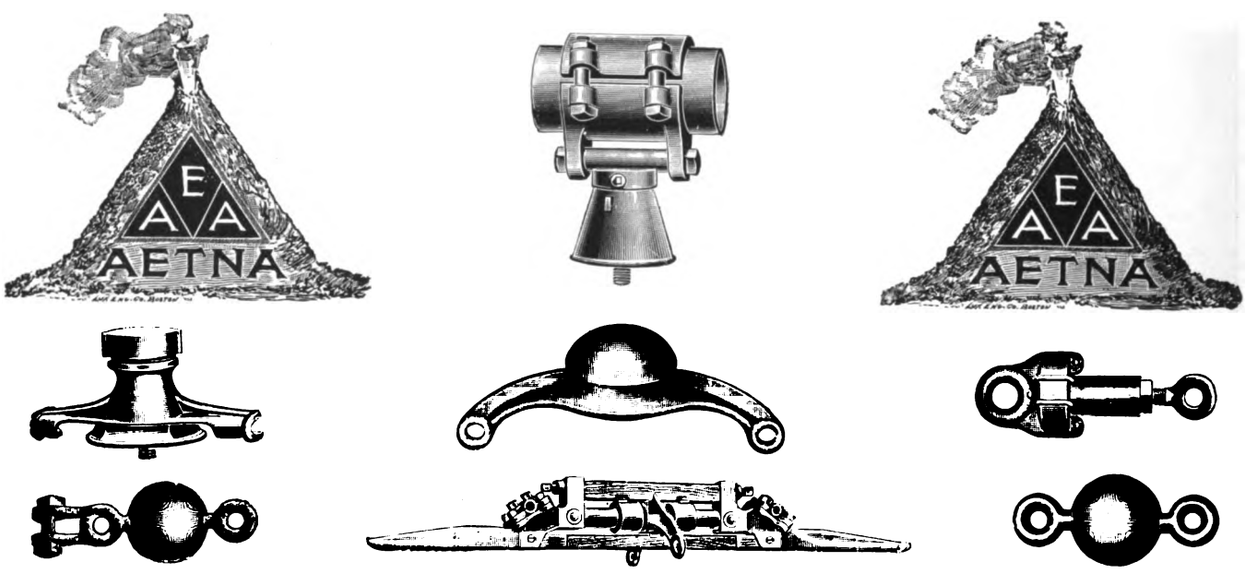

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MONTHLY SEASON TICKETS

TO BE SOLD AT STATION BOOKING OFFICES

AT EACH STATION a list of certain of the monthly season ticket rates is exhibited on the front of the booking office. These represent the season tickets for which there is the greatest demand at the station.

FOR THE CONVENIENCE OF THE PUBLIC arrangements have been made by which these tickets can be purchased at the booking office at once on the applicant filling up his or her name and address on a slip provided for the purpose

RENEWALS OF SEASON TICKETS so purchased can be obtained, without further formality, by returning the expired ticket not later than the day after its expiry, to the booking office of issue.

THE LIST OF MONTHLY TICKETS on sale at the booking offices will be extended as the demand arises

MONTHLY SEASON TICKETS for all journeys are sold, but applications for such tickets as are not included in the lists referred to should be made on the ordinary forms and will be dealt with on 24 hours notice. Such forms can either be handed in at the Booking Offices or sent direct to the Companies' Season Ticket Offices.

UNDERGROUND

LONDON ELECTRIC RAILWAY
CENTRAL LONDON RAILWAY
CITY & SOUTH LONDON RAILWAY
DISTRICT RAILWAY

OWING TO WAR CONDITIONS these Companies are short of staff. Public facilities have to be maintained with the available staff

A SIMPLER TICKET SYSTEM helps towards this end It reduces the work of checking and determining the use of tickets without leaving opportunities for abuse

ON AND FROM THE 1ST FEBRUARY 1916
STRIP TICKETS &
FOUR-WEEK SEASON TICKETS
WILL CEASE TO BE SOLD.

NEW MONTHLY-SEASON TICKETS will be on sale at the stations of the above Companies For particulars see other posters.

STRIP TICKETS sold prior to that date will be available for use up to the 30th April After that date the Company issuing them will redeem them for the price originally paid

FOUR-WEEK SEASONS issued prior to that date will be available for use until their expiry

Electric Railway House, Broadway, Westminster, S.W.

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STANDARD AND TRACTION TYPE

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There are no better Drawn Wire Lamps

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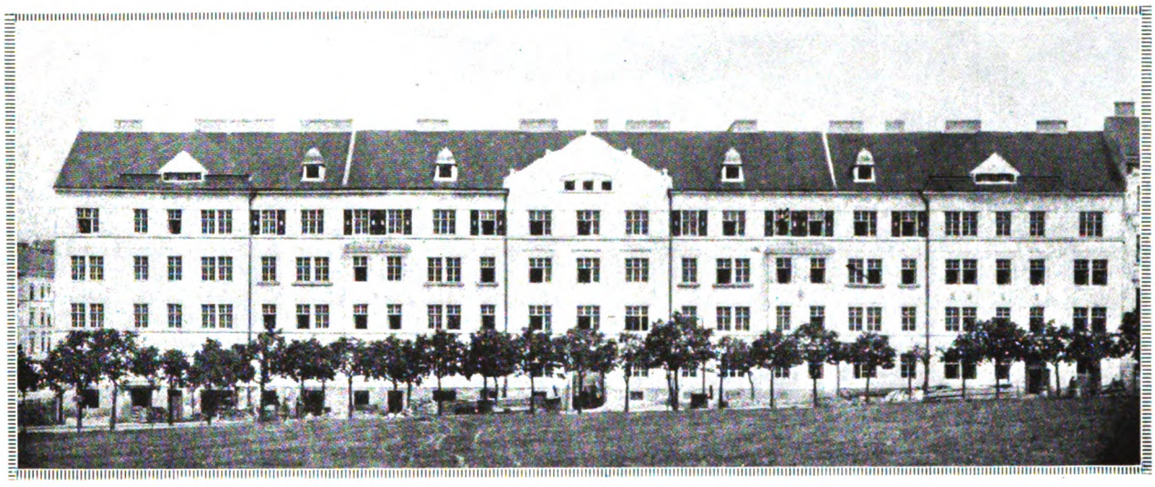
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, MARCH 9, 1916. VOL. XXXIX.

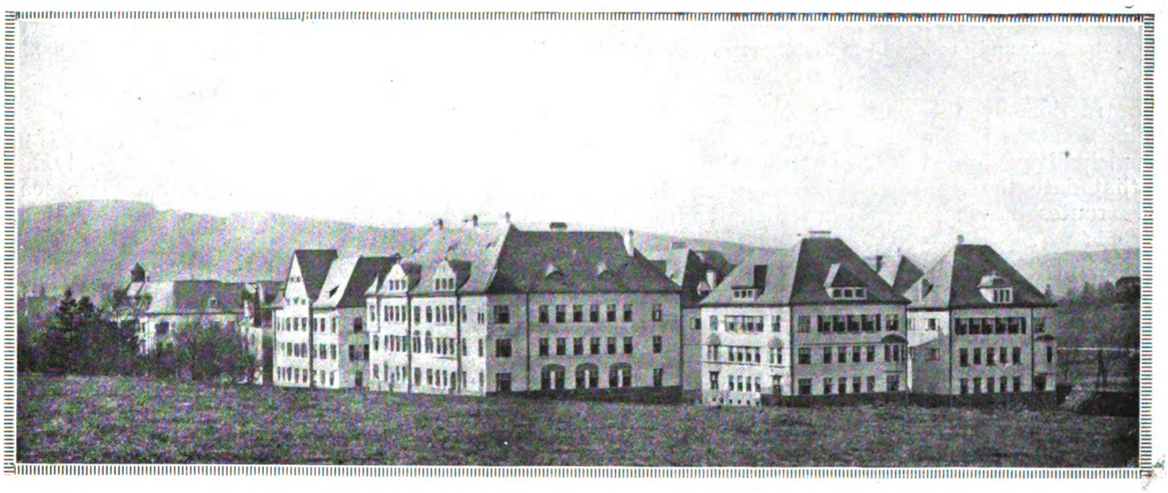
VIENNA TRAMWAYS SEMI-CENTENARY.

SOME FEATURES OF AN IMPORTANT MUNICIPAL SYSTEM THAT BEFORE THE WAR OBTAINED GREAT SUCCESS.

The Vienna tramways celebrated their semi-centenary in the midst of the war. The first horse tramcar was run in the Austrian capital on October 4, 1865, over a line 2·5 miles in length. From this small beginning has been built up during the last fifty years an undertaking which now forms the greatest municipal enterprise of the city of Vienna, and provides transport for its two million inhabitants.



Typical Apartment House for Vienna Municipal Tramway Employees.



A Group of Suburban Flats for Vienna Municipal Tramway Employees.

The original undertaking was, of course, the result of private enterprise, and although the company was well managed, the position gradually became more difficult for the private owners. A great strike in 1897 proved the turning point in the history of the undertaking, and led the Vienna Council to consider the traffic question. The cry for municipalisation increased, and the late Dr. Lueger, who was a convinced municipalist, succeeded in bringing about the change. In March, 1899, the municipality took over the concession of the Vienna Tramways Company, and soon a great advance was made by the introduction of

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electric traction. The city found some difficulty, however, in carrying out the equipment, and renewed agitation resulted in the forming of a company for the construction and working of the tramways. This company undertook to convert fifty miles of tramways and to work them for the city, but opposition to this arrangement ensued, and in January, 1902, the municipality finally took over the undertaking, and entrusted to Siemens and Halske the construction of a further 25 miles of line, which under the terms of the arrangement they were bound to complete in 1903.

Certain tramways were still in the hands of a company, and in Vienna, as elsewhere, divided control in the provision of local transport gave rise to numerous practical difficulties. For instance, while the municipal tramways gave cheap early morning tickets to workmen, the company were unable to offer the same privileges without loss. It was also a cause of complaint that the rates of wages and salaries paid by the two undertakings varied considerably. The municipality eventually decided that it would be in the public interest for the whole of the tramways to be owned and worked by them, and consequently, in May, 1902, the other tramways were purchased, and the lines were converted to

Motor Car and Snow Ploughs in Vienna.

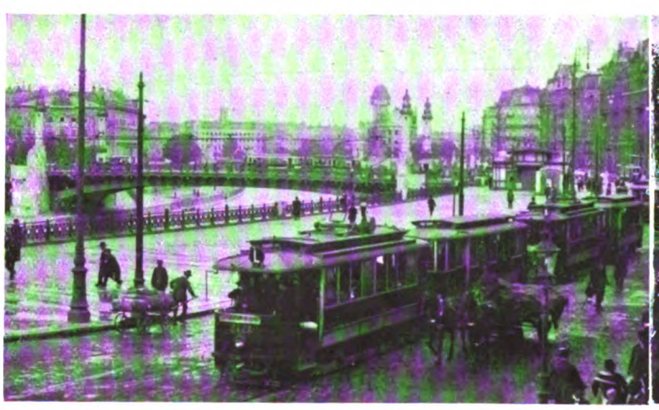
suburbs, and the speed of the cars raised from 6·2 to about 7·5 miles per hour. These improvements have led to marked alterations in the conditions of living in the city, and it is generally felt that the action of the municipality in acquiring the whole of the lines has been justified.

Motor Cars and Trailers in Mariahilferstrasse.

Departure Point of "Round Vienna" Route.

electric traction by the Austrian Schuckert Works. Centralisation was thus effected, and on July 1, 1903, the municipality assumed control of the whole system. Since that date the tramways have been greatly extended, routes having been constructed into new

Under municipal control great attention has been paid to technical questions, including both track construction and car design, and careful study has been given to traffic requirements. A notable feature is the care that the municipality has paid to the housing



Motor Cars and Trailers on Franz-Joseph Quay.

Tramway Queues at the Central Cemetery, Vienna.

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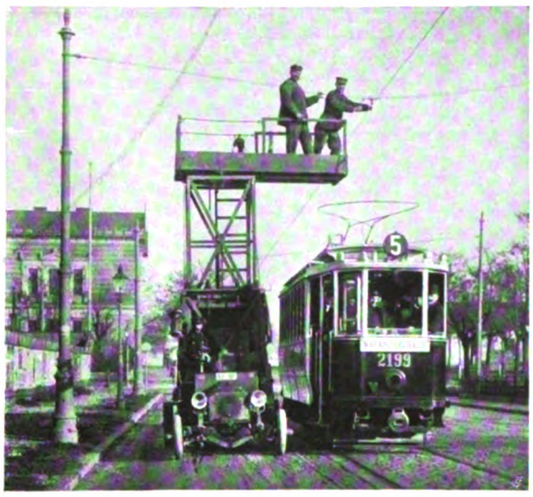
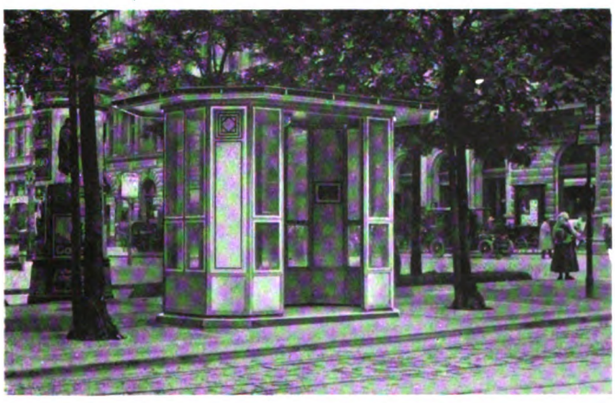
question. Well-built blocks of flats of attractive architectural design have been constructed for the accommodation of the employees and their families. No less than 6,600 separate apartments have been provided under healthy conditions and amid attractive surroundings. Public baths and playgrounds have been erected in connection with the dwellings, and every effort has been made to add to the amenities of life among the employees. Previous to the outbreak of war 12,000 men were on the roster of the tramways department. The municipality desires to make the work of its employees a career, and provision is made for pensions after thirty years' or thirty-five years' service.



Motor Tower Wagon and Standard Vienna Vestibule Car.

The undertaking has been financially successful, and since 1903 a total of 26,000,000 kr. has been paid to the municipality out of the profits. The war has seriously interfered with the progress of the undertaking, but few particulars can be obtained as to the exact position.

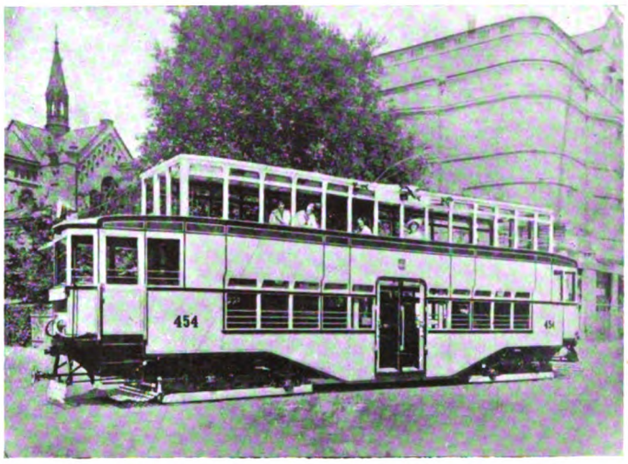
The *Elektrische Kraftbetriebe und Bahnen*, of Berlin, in the course of a long article on the history of the Vienna tramways, published in a recent issue, does not attempt to give any details of the results of the war upon the undertaking, but it alludes to the special services which have been performed for the authorities. A goods service, providing for the carriage of fuel and necessaries, has been organised, and a number of cars have been reconstructed to serve as ambulances, these cars apparently being used to convey the wounded from the railway stations to the hospitals. Herr Ludwig Spängler, the manager, and some of the officials have been decorated for the part which they have taken in the work.



Tramway Shelter at Vienna Stock Exchange.

MIDLAND RAILWAY STORAGE BATTERY LOCOMOTIVE.

About eighteen months ago the Midland Railway Company put into service a storage battery locomotive for shunting and sorting the coal traffic in the West India Dock Depot, London. The work was previously performed by horses in connection with a number of turntables situated in each road, and investigation showed that the task could be performed more satisfactorily and economically by an electric locomotive than by horses, hydraulic or electric capstans and snatch-heads.



Novel Type of Car Introduced in Vienna Shortly Before the War.

A locomotive is also considerably more flexible in operation than any of the alternative arrangements, and as the ordinary steam locomotive cannot enter the yard, the only access from the railway being by means of an hydraulic wagon lift, the whole of the work has to be performed by the electric locomotive. High speeds are, of course, unnecessary in working a yard of the type in question, and the maximum speed attained with full load is only about seven miles per hour, speeds up to twelve miles per hour being attained with light loads. The rated capacity of the locomotive is six loaded wagons weighing 15 tons each, and twelve light wagons of approximately 6 tons each.

Tramway Station at the Prater, Vienna.

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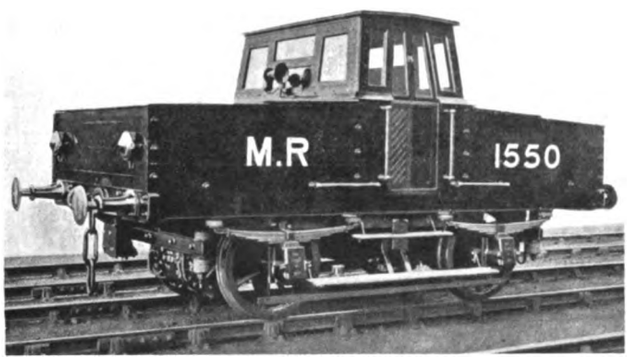
The weight complete with battery and all equipment is 17½ tons, and the wheel-base is 8 ft. 6 in.

The general appearance and method of construction of the locomotive is well shown in the accompanying illustration. There are two motors, one on each axle, of 22 H.P. each, supplied by Messrs. Dick, Kerr and Company. The battery, which is situated in the two end compartments, was provided by the D.P. Battery Company, Limited. It consists of 108 cells, 21-plate TL. type, and has a capacity of 300 ampere-hours. The cells are the D.P. Battery Company's standard train-lighting pattern in lead-lined teak boxes, and are fitted with "block" type lids.

It is important to note that the locomotive has not been out of service at any time on account of the failure of the battery, and that no single cell has failed since put to work about eighteen months ago. The battery has been in daily use (except Sundays), the discharge rate varying from 40 to 90 amperes, with occasional spurts up to 150 amperes.

The battery is charged every day from about 12.30 p.m. for one to two hours, and a "refreshing" charge is given in the early morning. When the battery was cleaned out the work was done without interrupting the service. The plates were in excellent condition.

It had been expected that the severe jolting occasioned by continual shunting of the coal wagons would cause many renewals of such parts as separators,



Midland Railway Storage Battery Locomotive.

ebonite sheets, etc. This was found, however, not to be the case; and out of over 2,000 wood separators in the battery it was necessary to renew only about three dozen. Only a very few ebonite sheets were split. This is partly due to the careful suspension of the truck and also to the tough qualities of the accessories. The four-bar bottom block, a special feature of the "D.P." cell, on which the plates stand, proved its worth; no shorting had taken place, and there was no indentation, as the weight is better distributed than on the two-bar block.

Control is by the ordinary series parallel method, providing two economical running speeds, but no restrictions are put on the drivers with regard to the use of the other notches. Braking is of the rheostatic type operated by the main controller, this method being very useful for shunting. A band brake with hand operation is also fitted to each axle, being equivalent to the tender brake on steam locomotives.

Charging is effected by a motor generator, the voltage of supply from the Poplar Borough Council of 460 volts being too high to offer any advantages for the use of a reverse booster. The generator is differentially compounded, so that after current is switched on further attention is unnecessary except in the case of a "gassing" charge.

GEAR-DRIVEN CONTINUOUS CURRENT TURBO-GENERATOR SET.

Recent developments in the science of gear cutting have attracted attention, chiefly on account of the introduction of high-speed gearing in the driving of ships, both mercantile and naval, whereby the lightness and economy of a high-speed turbine can be combined with the efficiency of a slow-speed propeller.

There is, however, another field which offers great possibilities for the use of gears in combination with turbines, viz., the driving of continuous current generators. Certain mechanical and electrical difficulties appear to be inseparable from the design of continuous current machines of any considerable output running at any speed approaching that desirable for an efficient steam turbine, with the consequence that up till very recently continuous current generators have either been driven by reciprocating engines, or, if turbine driven, have been subject to undeniable limitations in either speed or output, or both.

The direct current generator is essentially a moderate speed machine, and does not lend itself readily to construction for the high speeds of steam turbines. At the slow speeds of gas and oil engines, both direct and alternating current generators become large and costly for their output, and a good efficiency can only be obtained by further adding to the cost. At the moderate speeds of so-called "high speed steam engines" and motor generator sets conditions improve, and sound, high efficiency machines can be designed without difficulty.

In building continuous current direct coupled turbo-generator sets, mechanical difficulties arise in the construction of the commutator, in securing the armature windings, and in arranging that the running speed shall not be near the critical speed. Electrical difficulties arise on account of the high reactance volts of the coils undergoing commutation and high volts per commutator segment. To ensure satisfactory operation a field structure with compensating windings is usually employed, and the consequent extra excitation losses together with the rapid increase of core loss, friction, and windage at high speeds, combine to reduce the efficiency considerably in spite of reduced armature copper and shunt field losses. The compensated field construction also considerably increases the cost and the time required to build a machine.

As typical commercial efficiencies for the three types of generators we may take 91 per cent. for a 250 KW. 440 volt slow-speed machine, 93·5 per cent. for a moderate speed machine of the same rating, and 89 per cent. for a generator running at steam turbine speed. The reduction gear would have an efficiency of about 98 per cent., which gives 91·6 per cent. as the combined efficiency of the generator and gear. Geared turbo-generator sets can now be built for practically any output to compete in cost, efficiency, reliability, and floor space with either turbo-alternator rotary equipments or reciprocating-engine sets.

As indicated above, the gear-driven generator is built on normal lines, and therefore calls for little detailed description. Being designed to run at a fairly high speed, so as to keep the cost of gear and generator at a minimum, all details of design require careful attention.

The practice followed by the British Thomson-Houston Company to produce a sound, efficient, moderate speed generator may be outlined as follows:—Thin laminations of special steel are used for armature core and pole faces to reduce the core loss, as the frequency of the armature currents before commutation

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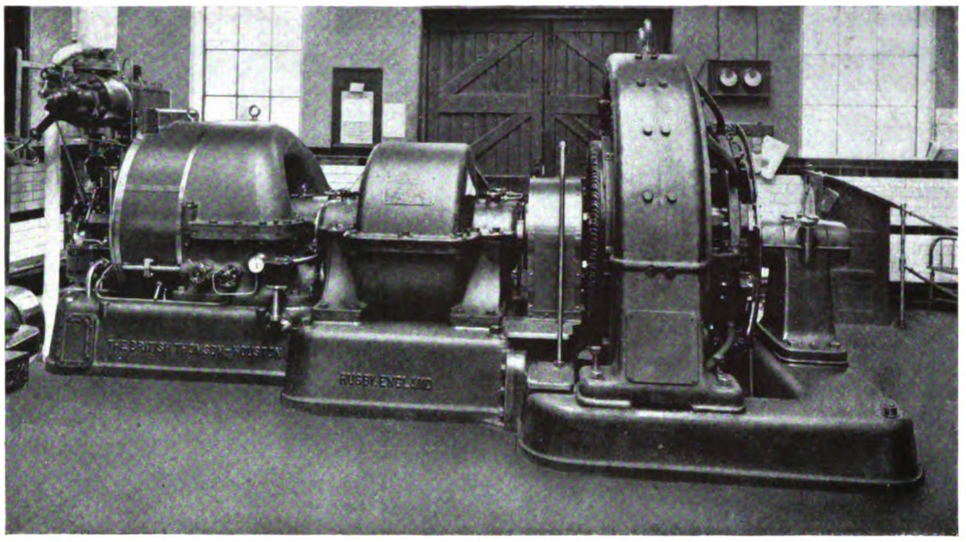
will be 40 to 50 cycles per second. Armature clamping bolts which pass through the core are insulated to reduce eddy currents. The air gap is made longer than would be the case with a slow speed machine, so that the distortion of the main flux caused by armature reaction is reduced.

The commutating poles are so designed that over the whole working range from no load to the guaranteed overload the commutating flux is practically proportional to the load on the machine. The commutating pole air gap is adjusted on test so that the reactance volts of the coils undergoing commutation are exactly neutralised. Diverters across the commutating pole windings are not used as, although they form a convenient method of test adjustment, the amount of current diverted is apt to vary on account of changes of resistances due to temperature and variation of the resistances of connections, which in the case of low resistance windings may form an appreciable item. Also, on varying loads, a plain diverter will not take a uniform share of the current as its inductance is very much less than that of the winding. Inductive diverters are difficult to adjust and are not satisfactory.

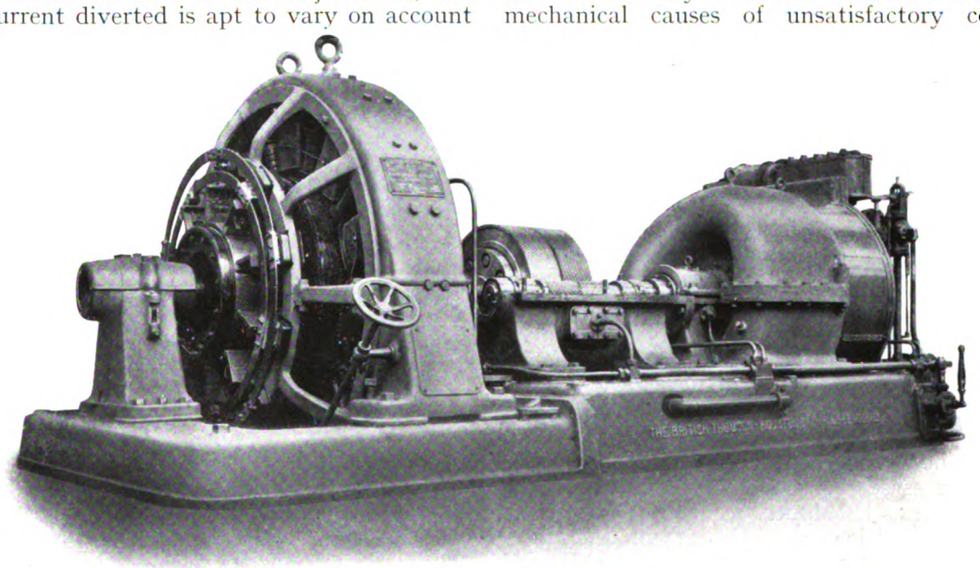
Even when adjusted to operate perfectly up to heavy overloads, commutating machines are always liable to flash over on heavy short circuits. To minimise the risk of flashing over and to reduce the damage caused by a flash, the clearance between adjacent brush brackets should be kept a maximum and the space between the commutator and the bearing should be kept free from bus rings or earthed metal parts as the flash always tends to spread outwards from the machine.

Reference to the illustrations will show that the B.T.H. design of brush gear fulfils these requirements. A substantial brush yoke supported from the magnet frame, brush springs designed to prevent brush chatter, and a carefully balanced armature eliminate the mechanical causes of unsatisfactory commutation. Graphite brushes reduce the commutator loss to a minimum and rapidly produce a hard polished skin on the commutator, the wear of which is very slight.

Equaliser rings fixed in an accessible position at the back of the armature prevent unbalanced magnetic pulls and equalise the distribution of the load between the several paths through the armature, which is of course parallel wound. The choice of a suitable speed



Gear-Driven Continuous Current Turbo-Generator Set.



Gear-Driven Continuous Current Turbo-Generator Set.

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and number of poles limits the volts per bar to a reasonable figure. The armature windings are secured against centrifugal force with an ample factor of safety by means of fibre wedges in the slot portion and steel wire binding bands on the ends.

A set recently installed by Mr. Cameron Gibson, the borough electrical engineer, in the power station of the Nuneaton Corporation, is an interesting example of a gear-driven set. It consists of a B.T.H. shunt-wound generator having a normal output of 1,500 amperes at from 470 to 500 volts, driven through double helical gearing by a B.T.H. Curtis turbine of 750 KW. normal capacity. The set has an overload capacity of 25 per cent. for two hours and 50 per cent. for five minutes. The complete set has been constructed by the British Thomson-Houston Company, and the turbine is of their standard three-stage design as used for driving alternators, and runs at 3,250 revolutions per minute, the gearing reducing the speed to 600 revolutions per minute for the generator. The turbine drives the pinion shaft through a double claw coupling, which allows the pinions to take their correct axial position without any end thrust being transmitted to the turbine shaft. The armature spider is bolted direct to a large flanged coupling on the slow speed shaft, the bearings of which consequently carry a portion of the armature weight.

The gears and bearings are completely enclosed and have a copious supply of oil from the main oil pressure system of the turbine, which also operates the servo-motor of the well-known B.T.H. governor gear. A return pipe from the bottom of the gear case leads the oil back to the main oil tank, whence the oil pump on the turbine delivers it through an oil cooler back to the supply pipes.

This set was put on commercial load in January of last year, after exhaustive tests in the shops of the makers had proved that guarantees were fully met, and the completely satisfactory manner in which the set has behaved since its installation has given all concerned perfect confidence in the future of this combination, and resulted in an order being given to the British Thomson-Houston Company for a duplicate set.

SOUTH SHIELDS STANDARD CAR.

The most recent type of car used by South Shields Corporation tramways is shown in the illustrations on the following page, for which we are indebted to Mr. J. C. Whiteley, general manager and electrical engineer. It will be seen that the car follows in general the standard practice in the design of four-wheeled top-covered cars. The open-air canopy seats are a valuable feature from the point of view of many passengers, and they are provided here with canopies of dimensions corresponding to those of the platforms. The main feature about the seating accommodation, however, is the fact that cross seats have been provided for the lower deck as well as the upper. This departure from the usual practice of longitudinal seats on the lower deck was also taken by the London County Council in the case of their new trailer cars. The car bodies, which were made by the Brush Electrical Engineering Company, are mounted on Peckham pendulum trucks. The wheel base is 7 ft. 6 in. Westinghouse 200 motors are provided, and the latest type of T. I. C. 1915 pattern controllers. In regard to the over-all height of the car, this had to be strictly limited, as the head room between the rail level and the underside of girders carrying a railway bridge, under which the cars run, is 16 ft. 1½ in. The seating capacity per car is 60, distributed as follows :—Inside lower saloon, 24 ; inside upper saloon, 28 ; on canopies, 8. The following are leading dimensions :—

	ft.	in.
Length of body over corner posts	17	5
Length of each platform	5	3½
Length over platforms	28	0
Total length over all	29	0
Width over sills	6	4½
Width over rocker mouldings	7	0
Width over roof	7	0
Clear height inside at centre lower saloon ...	6	6
Clear height inside at centre upper saloon ...	6	0
Overall height from rail to trolley base ...	16	1
Width of end door openings, lower saloon ...	1	11
Height of end door openings, lower saloon ...	6	1
Gauge	4	8½

LACRE TOWER WAGONS FOR SANTOS.

The 18-H.P. Lacre telescopic tower wagon illustrated below was built by the Lacre Motor Car Company to a repeat order from the City of Santos Improvements Company, Limited, who own a large fleet of Lacre cars, and at the present time have a chars-a-banc on

order. The telescopic platform of this tower wagon can be raised to a height of 16 ft. above the road level. The driver's seat holds three persons, and the dimensions of the box behind the tower are approximately 5 ft. 6 in. by 5 ft. 3 in. There is a seat at the rear for two persons.

PETROGRAD TRAMWAYS CRISIS.

The Petrograd electric tramways undertaking is threatened with paralysis ; in fact, it is stated in the Petrograd press that quite 60 per cent. of the cars are not now running, for one reason or another, including want of repairs and shortage of fuel at the power-station, but generally for want of efficient maintenance. Various engineering shops in the country have cars ready for delivery to supplement those that are running, but owing to the unfortunate interruption on the Russian railways, it has been found impossible to deliver these cars to Petrograd. The consequence is that the cars now running are crowded to "suffocation," whilst it is made impossible for the conductors to collect the fares. The scandal, for so it is called, has been brought before Petrograd Town Council, but it has been found impossible to hold anybody answerable for the confusion so caused. According to the newspapers, it now appears to be nobody's business to manage the tramways. The resignation just announced of the Town Governor has not contributed to simplify the many problems, including the tramway difficulties that confront the authorities.

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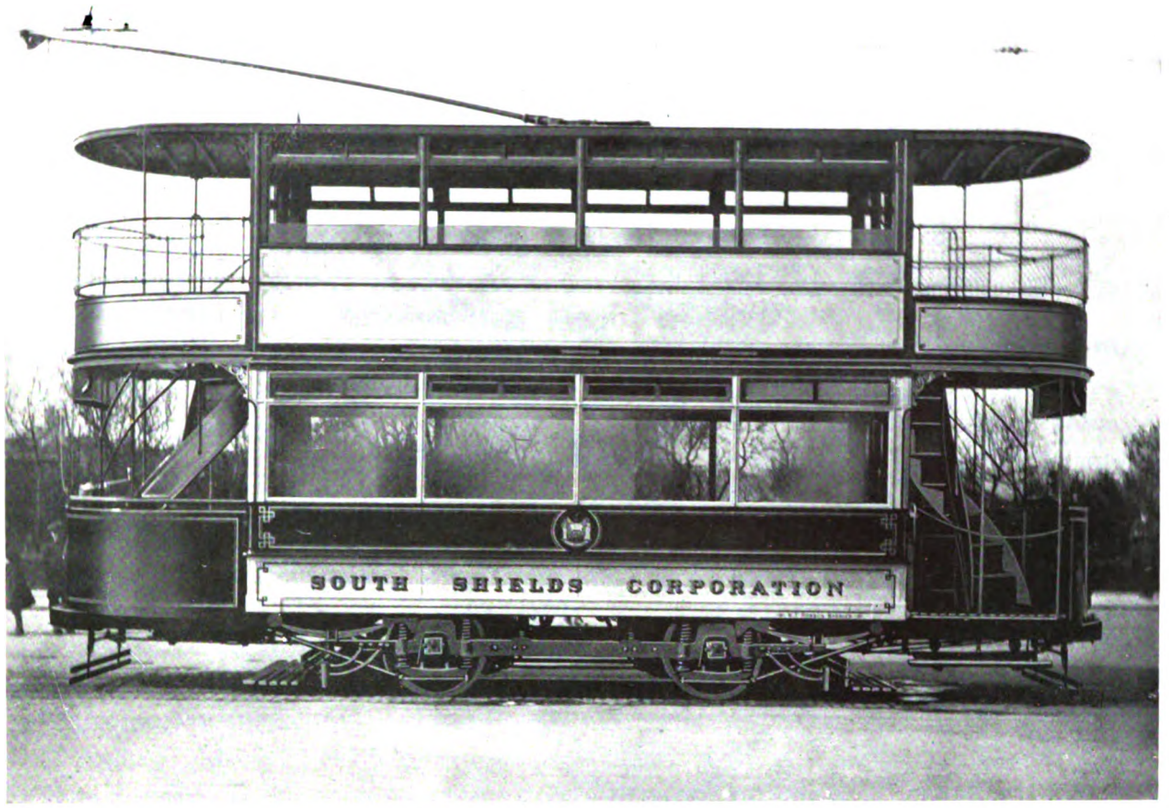
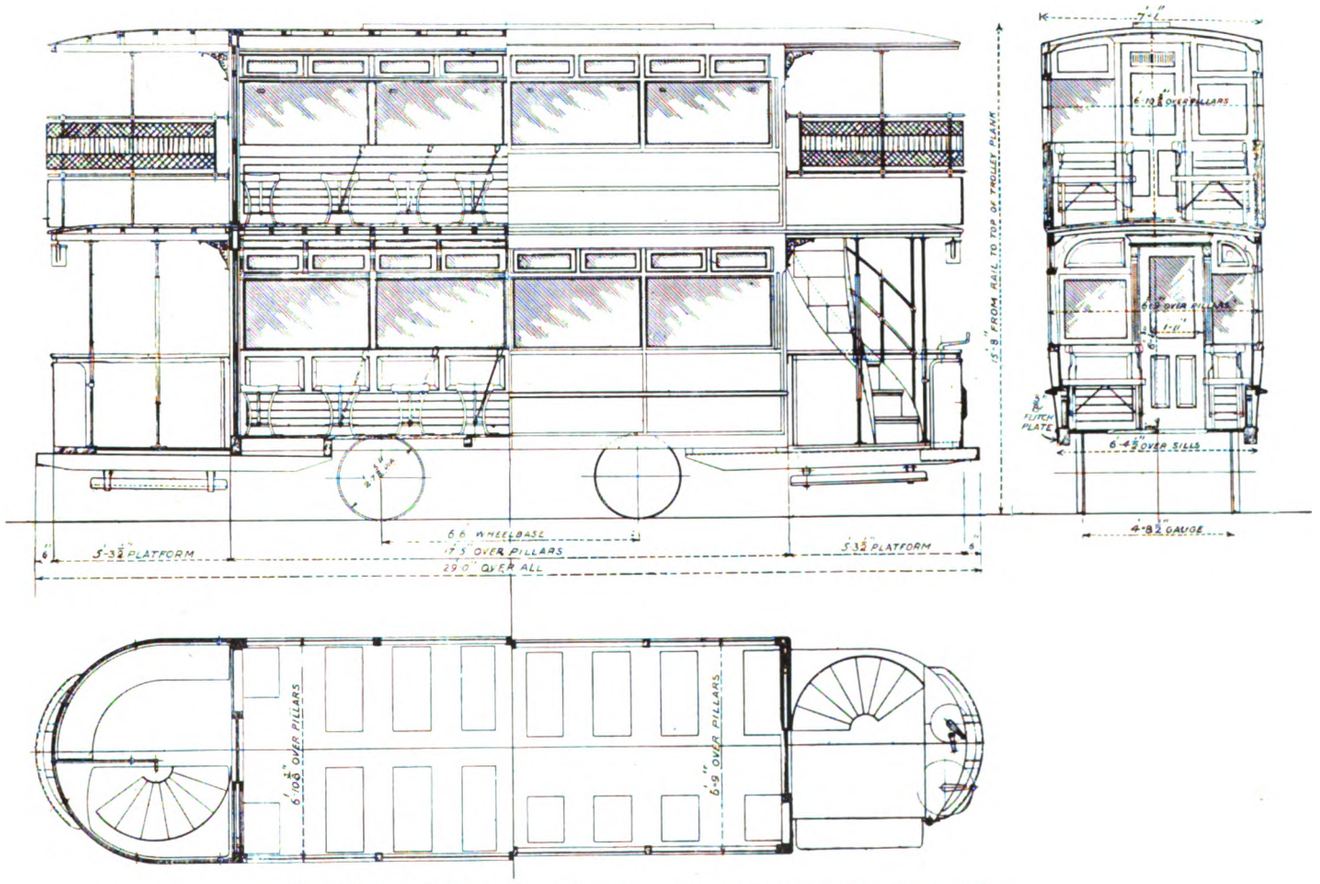


South Shields Corporation Tramway, Side View.



Elevations and Plan of Standard Type Car—South Shields Corporation.

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THE
Tramway and Railway World

FOUNDED IN 1892 AND PUBLISHED BY
THE TRAMWAY AND RAILWAY WORLD PUBLISHING COMPANY, LIMITED,
AMBERLEY HOUSE, NORFOLK STREET, LONDON, W.C.

SUBSCRIPTION:

THE TRAMWAY AND RAILWAY WORLD can be obtained, post free, at the following rates:

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THE EDITORIAL AND PUBLISHING OFFICES OF
THE TRAMWAY AND RAILWAY WORLD
ARE AT AMBERLEY HOUSE, NORFOLK STREET,
LONDON, W.C.

Telegraphic Address: "TRAMIGRO, LONDON."
Telephone No.: GERRARD 2948.

LONDON, MARCH 9, 1916.

Street Traffic Regulation.

The recent extension of the areas in which reduced lighting is compulsory calls for further attention to the necessity for strict regulation of street traffic with the object of minimising accidents and also of facilitating transit. In London one of the chief troubles is in connection with vehicles overtaking tramcars at stopping places. County Council and police regulations as to the breakdown of vehicles on tramway tracks and as to slow-moving traffic keeping close in to the kerb seem to be fairly satisfactory. But in the darkened streets passengers entering and leaving tramcars are still subject to the danger of being run down by overtaking vehicles, especially by those of the high-speed motor variety. A great deal more should be done to minimise this danger. As usual, Glasgow appears to be further ahead in the matter of regulation than many other places. Since May 1 of last year there has been in force an admirable set of bye-laws for regulating street traffic. These bye-laws were made under powers conferred by Section 28 of the Glasgow Corporation Order Confirmation Act, 1912. The regulations were made by the city authorities on April 16, 1914, but were not confirmed by the Secretary for Scotland till a year later. No. 10 provides that when a tramcar is standing at a stopping place every driver of a vehicle who intends to pass on the near side shall draw up until the roadway is clear of passengers entering or leaving the car. Other bye-laws deal with slow-going traffic, breakdowns, etc. The penalty for breach of the regulations is a fine not exceeding 40s. The Glasgow tramway department have found Bye-law 10 of very great service, and it is rarely that a vehicle is to be seen passing through a crowd of passengers. Formerly it was quite a common occurrence. An order for restricted lighting came into force in Glasgow on February 25, so the bye-law ought to be of more service now than ever.

There seems to be no good reason why a bye-law of the kind should not be applied to every town and district where there are tramways. It is a very unsatisfactory thing that reckless drivers, whether of motor or horse vehicles, should be at liberty to imperil the lives of tramway passengers and can only be proceeded against after the damage has been done. What is wanted is the prevention of accidents. The subject has been agitated afresh in Manchester recently, especially since a passenger was killed by a motor cab as he was leaving a tramcar. Before that, however, the Manchester Watch Committee had recommended the Corporation to consider the question of obtaining legislation to deal with the subject. Manchester also is keenly alive to the necessity of having a bye-law to compel heavy motor and other vehicles to keep to their proper side of the road. Heavy vehicles with great loads are a prominent feature in Manchester street traffic, and years ago the tramway department organised a breakdown service which works with the speed of the fire brigade for the removal of broken-down lorries from the tramway tracks. The evil is increasing owing to the rapidly expanding heavy motor traffic, and Mr. McElroy, the tramway manager, in a recent report, insists on the necessity of a bye-law to deal with it. Tramway and other fast traffic is obstructed even when there is no breakdown of a heavy lorry, and the cost of track maintenance is increased. It is surely time that Manchester and other places in a similar position should have bye-laws like those of Glasgow. In regard to London, it is the case of the tramcar at a stopping-place which is most urgent, and

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doubtless the Metropolitan Police have or can obtain power to enforce the necessary regulation. Their bye-law insisting on lower speed for motor vehicles at night might also with advantage be a little more stringent.

A Ministry of Commerce.

In this issue we deal at length with the important events of the past month bearing on the subject of British trade after the war. The signs are hopeful for the establishment of a protective tariff, with preferential trade within the Empire and with our Allies. The Government seem to be gradually coming round to the views long held by those best acquainted with the position and the needs of British industries, but even with the best will the carrying out of such a scheme may take some time. There is, however, another proposal which could be promptly realised and which is, in fact, the first logical step in the revolution of our commercial policy. This is the constitution of a Ministry of Commerce. Upon this the commercial and industrial interests of the country should concentrate. Without relaxing efforts in favour of import duties on German goods, let full energy be turned on getting this Ministry constituted. There are endless arguments in favour of it; there seem to be no valid reasons against it. Leave to the Board of Trade its administrative work in regard to railways, shipping, and so forth, and let us have a Ministry of Commerce charged with the sole duty of fostering British trade. Such fostering can be carried out in many ways by administrative action, and whenever the Minister of Commerce found that he needed fresh legislative powers he could come to Parliament with a Bill to give the authority needed. The new Minister should be a thoroughly practical business man of initiative and wide experience, and his department should be endued with the business spirit. If by the time the Ministry has got into full swing, protection has not been granted by Parliament against Germany, a practical Minister of Commerce in full touch with the business of the country would not be long in asking for such a measure. The longer the time before a tariff is imposed, the more urgent and strenuous will be the demand for it from the country, and the greater the ease with which the Government of the day will be converted—if conversion it then needs. In fact, we can hardly conceive a competent Minister of Commerce who would not be a strong advocate of a measure of reform so urgently demanded and needed by many of our industries. A Ministry of Commerce has long been required, but never before has there been such an opportunity of bringing it to fruition.

"Safety First."

The officials of the London traffic group could not have chosen a more timely question for consideration at their next efficiency meeting than the safety of the public. This is a matter in which this country is far behind the United States, where the "safety first" movement has spread from steam railways to street railways, with the result that in several cities a public department has been constituted, charged with the duty of promoting safe working on the part of both operators and the general public. In the United Kingdom the Great Western Railway has devoted a great deal of attention to the subject during the past three years, and before the war a considerable effort in the same direction was made by the Glasgow Tramways Department. Yet the need for a safety mission is greater now than it has ever been. The effect of the restricted lighting in the Metropolis upon the number of persons killed and injured has only to be realised to induce every provinicial traffic authority to put forth a special endeavour to prevent an extension of the danger to their localities, now that the diminished lighting regulations have been extended to so wide an area. Probably it is the lack of municipal spirit and cohesion among Londoners that accounts for their sitting dumb under the perils with which motor vehicles have surrounded them during the past decade. It is true that in 1913 one public-spirited Member of Parliament induced the Government to hold an inquiry into accidents due to mechanically-propelled vehicles. The revelations then made were serious enough to merit drastic action, but unfortunately the control of London's highways is vested in a Government department that fails to recognise its responsibility. The Joint Committee strongly recommended the creation of an independent authority for the control of London traffic, as was also suggested by the Royal Commission. Strenuous efforts were put forth

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by the County Council to induce the Government to adopt this twice-urged reform, but the indifference of the people to matters that concern the public welfare has allowed the question to sink into oblivion. We therefore welcome the discussion on the part of the officials of the allied transit companies, and would urge that an attempt should be made to secure unity of action in an educational campaign. In this, the County Council, the omnibus companies, and the automobile organisations might all co-operate. The need is imperative, for in 1915 there were 867 fatalities, as compared with 625 in 1914 and 658 in 1913. These figures take no account of the greater number of persons who were only injured. Of the fatalities last year, 191 were due to private motor cars, 156 to motor omnibuses, 150 to trade and commercial motor vehicles, 87 to tramcars, 66 to motor cabs, and 28 to motor cycles. Horse-drawn trade vehicles ended the lives of 162 persons. That an effort to secure greater regard for safety on the part of drivers, passengers, and pedestrians will financially benefit the several traction undertakings is shown by the report presented to the County Council on the settlement of claims made in 1915 on account of accidents in the working of the tramways. A sum of £10,004 was paid in respect of 1,134 claims, and in 35 other cases actions were brought against the Council, with the result that in 14 a verdict was given against the authority, entailing payment of £634 and costs. Doubtless the claims department of the omnibus companies have to deal with a greater number of cases.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

It has been decided to hold the annual meeting and congress of the Tramways and Light Railways Association on Friday, June 30. Some of the out-of-town members having expressed a wish that matters should be so arranged as not to necessitate their spending more than one night in London, it has been arranged to have the papers and discussions at 2.30 p.m., and to devote the afternoon thereto. Members and their friends will dine together at 7.30 p.m. The same procedure will be adopted as last year—i.e., the dinner will be quite informal, and there will be no official guests, and no musical entertainment. The secretary of the association, Mr. A. de Turckheim, will be glad to hear from any member who wishes to read a paper.

Opening of a Tramway on a Grass Track.—Colonel Druitt, R.E., on February 21 inspected the extension of Doncaster Corporation Tramways to the new villages of Woodlands and Highfields, near Brodsworth Colliery, and in the afternoon the public service was inaugurated. The extension, which is 4½ miles in length, has cost £20,000, of which sum about £2,000 was expended in the removal of telegraph poles, the track for the most part being on the grass verge on the west side of the Great North Road. This idea emanated from Mr. F. S. Rayner, the tramways manager and electrical engineer. As the track will not be used by other traffic its maintenance cost should be low.

TRAMWAYS PERMANENT WAY MAINTENANCE.

To the Editor of the Tramway and Railway World.

Sir,—Referring to the paragraph in your issue of February 10, reporting the action of the Aberdeen Corporation with reference to the Aberdeen tramways permanent way maintenance, I should say that the average person not in possession of the full facts bearing on the matter would form the opinion that maintenance of the permanent way in connection with tramways can be carried out by the borough surveyor at less expense than if carried out by the manager of the undertaking.

This I dispute. Certainly statistics issued by the borough surveyor of Aberdeen point to this, but the old saying that "figures may be made to prove anything" applies in this case. For instance, as general manager of the Blackburn Corporation Tramways, the permanent way is under my control, and is shown in the statistics got out by the Aberdeen surveyor as costing £151 annually for maintenance per mile of single track. This figure includes renewals and relaying, which in Aberdeen is provided for out of a depreciation and renewals account.

In Blackburn this is different; instead of having ear-marked fixed amounts yearly for this purpose, the track is renewed out of revenue according to the requirements thereof, which tends to show the charges in revenue to be exorbitant, which is not so.

I am convinced that so far as Blackburn is concerned, this policy can be carried out and still yield a profit on the working of the system, as the charges on this account will remain almost stationary, and the track still be kept up to a high standard of efficiency without letting it get run down and thereby causing the cost at some particular time to be very heavy.

Considering my own case against a surveyor-controlled system, I do not intend to take second place in the matter of cost.

As to efficiency, this has not entered into the article, but permit me to state that a tramway manager knows his requirements as to the condition of the track for keeping down his running costs, and will see that such requirements are fulfilled; on the other hand, I should not think a borough surveyor is so interested beyond the particular work for which he is responsible.

My policy is—departmental management under control of one head, not divided amongst two or three persons, which in case of mismanagement means no one.

Yours faithfully,

J. H. Cowell,
General Manager.

Tramways Office, Blackburn,
February 28, 1916.

COLLECTION OF TICKETS AND REDUCTION OF IMPORTED PAPER-MAKING MATERIAL.

To the Editor of The Tramway and Railway World.

Dear Sir,—For many years I have advocated the collection of tickets by the conductor for the purpose of checking fares. The restriction of imported paper-making material, particularly wood pulp, by one third, furnishes another powerful reason why my contention should be admitted.

I submit that the lessened supply of ticket-making material would be largely met by all tramway and omnibus authorities collecting, packing, and returning the tickets after use to the ticket material makers, by ordinary sale or arrangement with the printers.

Henry Mozley,
General Manager.

Burnley Corporation Tramways,
General Offices, Queen's Gate, Burnley,
February 21, 1916.

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TRADE AFTER THE WAR.

THE ADVISORY SUB-COMMITTEE'S REPORT.
RESOLUTIONS OF CHAMBERS OF COMMERCE.
THE NEW ATTITUDE OF THE GOVERNMENT.

We are living in remarkable times. In matters of trade and commercial policy, no less than in military affairs, we see the upheaval which is in progress. Great and significant symptoms of the coming trade revolution have manifested themselves during the last few weeks. These include the report of a Sub-committee of the Advisory Committee of the Board of Trade on Commercial Intelligence, the resolutions passed by the Association of Chambers of Commerce, and the declarations made on behalf of the Government by Mr. McKenna (Chancellor of the Exchequer) and Mr. Bonar Law (Secretary for the Colonies). If resolute Government action follows on all these declarations, the country will find itself on the way to being independent in its trade, free from German commercial menace, and in possession of a tariff which will protect it from hostile trade action in the future.

THE ADVISORY COMMITTEE'S REPORT.

To take this matter first—as it was first in point of time among the subjects referred to, having been issued early in February—the sub-committee were appointed to report with respect to measures for securing the position after the war of certain branches of British industry. The report has been adopted by the Advisory Committee and presented to the Board of Trade. It is full of common sense and useful proposals, but the outstanding feature is that it recommends protective tariffs, in the case of the industries dealt with, against Germany. It is a practical document based on present actual circumstances.

Though the proposals of the sub-committee are important in principle, the inquiry was restricted for the purpose of showing what steps should be taken to secure the position after the war of firms who have undertaken certain industries in consequence of the exchange meetings leading up to the British Industries Fairs held under the auspices of the Board of Trade. The industries in regard to which the sub-committee inquired were paper manufacture, printing, stationery, jewellers and silversmiths, cutlery, fancy leather goods, glass-ware, china and earthen-ware, toys, electrical apparatus, magnetos, and brushes and brooms. From a table of imports into this country in 1913, it appears that the value of electrical machinery imported was £1,346,000, of which no less than £721,000 worth came from Germany. The value of magnetos imported was £500,000, of which all but £25,000 worth came from Germany. Out of £196,000 worth of imports of electric glow lamps, £156,000 worth was German. The total imports in all the trades considered were valued at £16,000,000, of which practically one-half came from Germany. On the other hand, under many of the headings, there are large British exports.

One proposal, if given effect to, would carry out a principle for which we have long contended in these pages. It is that Government departments, local authorities and statutory bodies controlling money raised by taxes or rates should be under legal obligation to purchase as far as possible only goods produced within the British Empire. For some time before the war began there was an improvement in some quarters, but the proposal of the sub-committee is none the less necessary.

One of the most important recommendations of the sub-committee is that the Government should consider anew the advisability of establishing a Ministry of Commerce, charged solely with the safe-guarding and extension of British industry and trade, and freed from the regulative duties in respect of railways, shipping, and harbours, and the duties in respect of labour which at present devolve on the Board of Trade. It is generally felt that the Board of Trade has too much to do, and that a Ministry of Commerce is urgently needed. The witnesses for the electrical trades who appeared before the sub-committee were specially strong on this point.

THE NEED FOR A TARIFF.

The witnesses and the memoranda which were sent in joined in regarding all the other proposals as of secondary importance in comparison with the question of tariff protection after the war. The opinion at which the sub-committee arrived is that where the national supply of certain manufactured articles, which are of vital importance to the national safety, or are essential to other industries, has fallen into the hands of manufacturers and traders outside this country, British manufacturers ready to undertake the manufacture of such articles in this country should be afforded sufficient tariff protection to enable them to maintain such production after the war. This resolution is somewhat limited in its scope, but the sub-committee went further. They said that in view of the desire for Imperial preference, and of the fact that the present high direct taxation tends to raise the rate of interest on money, it will be necessary to impose some widely-spread import duties. Such duties would go a long way towards satisfying the requests for special protective treatment for the industries which the sub-committee had under consideration.

The Council of the British Electrical and Allied Manufacturers' Association, we are glad to record, took a prominent part in the proceedings before the sub-committee. On the subject of tariffs, they put forward important proposals in favour of an Imperial Customs Union, a tariff on all imported goods which can be efficiently and economically manufactured in British workshops, a scheme of Imperial preference, a smaller preference for our Allies, any preference possible to neutral nations, and a highly protective tariff against German and Austrian goods.

Having reviewed a few features of this report, it may now be pointed out that the evidence brought before the sub-committee, the recommendations of that body, the resolutions passed by the Chambers of Commerce on the last day of February, and the first and second days of March, and the declarations of Cabinet Ministers to that association, all show that the feeling in favour of a tariff against Germany has become very general and is now the preponderating view. Free traders and free-trade newspapers have been converted. The case for the tariff is overwhelming in regard to those British manufacturers who have put down plant and found capital for lines of manufacture which hitherto have been mainly or entirely German or Austrian.

There is profound truth in the suggestion that after the war the attraction of the cheapness of German goods will be such as to weaken appreciably in the case of many buyers in this country the prejudice created by the war against things German and Austrian. Memories are proverbially short, and they will be made shorter where there is some supposed advantage associated with the process of forgetting. This applies not only to the individual buyer, but to such bodies as municipalities who have to deal with the ratepayers' money. They have been for years accustomed to buy the cheapest article, irrespective of origin and often of quality, and old habits are hard to break. A tariff

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would prevent the German article from being the cheapest, so that the habit might go on. Without a tariff, one cannot rely on the continued patriotism of the public in the matter of purchasing. It is necessary, for the futue of our industries and the prosperity of the country generally, to make certain against the menace of an unscrupulous and penetrating foreign competition.

The Conversion of Manchester.

Even Manchester has now come into the tariff fold. It was the municipality of that city which some years ago filled up its big Stuart Street electric power station with German electrical machinery. But the Corporation have now seen the error of their ways and have adopted a standing order declaring that no contract shall be entered into with any person of German or Austrian nationality, or with any firm or company whose subscribed capital is held or controlled to the extent of one third or upwards by persons of German or Austrian nationality.

More important still is the revolution which was wrought in the latter part of February in the position of the Manchester Chamber of Commerce. Against the will of the majority of the directors of the Chamber, Cobdenism has been overthrown, and this important Chamber now marches with the vast majority of the others. The directors of the Chamber, in view of the then approaching meeting of the Association of Chambers, put forward a memorandum in favour of the continuance of free trade. This was defeated at a meeting of the Chamber in the middle of February by the carrying of a motion to refer the matter back to the directors. The latter demanded a poll, which resulted on February 21st in the memorandum being referred back by 988 votes against 527.

Mr. Docker and a Business Parliament.

Another significant feature of the times is the speech made by Mr. F. Dudley Docker at Birmingham, on February 23, when presiding at a lecture on engineering and public policy by Mr. T. C. Elder, under the auspices of the British Electrical and Allied Manufacturers' Association. In view of the eminent position which Mr. Docker holds in the business world, his opinions carry great weight. He pointed out that had a Ministry of Commerce been in existence at the beginning of the war, there would have been none of the scandalous waste of men, money, and brains, and but little of the labour trouble. He contended that it is the duty of manufacturers to insist absolutely that in future their voices must be heard, and that they must have a representation in the Government. He laid it down that the way to achieve this is to form one large association of business men, to be called the Business Parliament—a body which must be strong enough to give effective expression to its views and its requirements. It would be able to render invaluable service, helpful and advisory, to any Government which might have the duty of arranging our tariff system.

The Associated Chambers.

We now come to the highly important decisions of the Association of Chambers of Commerce. They were reached at a special meeting held in London on February 29 and March 1 and 2, for the purpose of considering problems of trade after the war. The main resolutions were submitted by the Norwich Chamber of Commerce. The general resolution, which was moved by Sir Algernon Firth, President of the Association, and adopted, declared that the strength and safety of the empire lie in ability to produce what it requires from its own soil and factories. Unanimous assent was given to a resolution declaring that the Government should take immediate steps to create a Ministry of Commerce and Industry with a Minister of Cabinet rank, aided by a Permanent Advisory Council, consisting of representatives of the Foreign, Colonial, and India Offices, the self-governing Dominions, and the leading commercial interests of the empire.

The Glasgow Chamber of Commerce presented a resolution asking the Government to consult the Governments of the Dominions and ascertain their views regarding the trade problems arising as the result of the war, especially in regard to reciprocal trading, and the regulation of trade relations with enemy countries and the control of businesses in the empire managed or owned by the subjects of enemy countries. This was adopted, as was also a very important resolution proposed by the London Chamber declaring that provision should be made for preferential reciprocal trading relations between all parts of the British Empire and between the empire and allied countries, for the favourable treatment of neutral countries, and for restricting by tariffs and otherwise trade relations with all enemy countries, so as to render dumping and a return to pre-war conditions impossible. The Government are being asked to confer with representatives of the Colonies, the Allies, and this country on the subject.

It is important to note that the conference unanimously passed a resolution approving the recommendations in the report of the Sub-committee of the Advisory Committee of the Board of Trade on Commercial Intelligence—the report which is dealt with in the first part of this article.

The Promising Attitude of the Government.

Most hopeful symptoms of the changing attitude of the Government on trade questions were evident from the speeches delivered at luncheons in connection with the congress by Mr. McKenna, Chancellor of the Exchequer, and Mr. Bonar Law, Secretary for the Colonies. In view of the fact that the former belonged to the late free-trade Government, his declaration may be described as epoch-making. He pointed out that we had found ourselves dependent in many essential matters of our trade on a nation which planned and provoked the war. He did not think that as a nation, whether by the individual efforts of our traders or with the necessary assistance of the Government, we ought ever to allow ourselves to be placed in that position again. The Government, he announced, were prepared to give assistance to the development of foreign trade in order to ensure that our enemies shall not have the control of that trade which they have enjoyed in the past. Mr. Bonar Law, who of course has been a tariff reformer all along, told his audience that we must begin from a new basis, that we must put aside all preconceived ideas on the subject. The resources of the British Empire, he affirmed, will never again be exploited by the Germans. He insisted on the necessity of making the empire independent from a trade point of view, and he made the important announcement that arrangements are being made for an economic conference of the Allies. This conference will deal both with war conditions and with what will happen after the war.

These are matters of fact, but just before this issue of the Tramway and Railway World went to press a report emanating from well-informed quarters was circulated that the Government intend shortly to inaugurate an important change in our commercial and fiscal policy. It is understood that the Government are to consider this matter fully before the approaching economic conference with the Allies. This may be the beginning of building a wall against German trade after the war.

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Taking everything into account, it may be affirmed that the manufacturing and trading interests of this country and of the empire have a brighter prospect of achieving the reforms they desire than has existed at any previous time. Thus it is to be hoped that our industries will emerge from the war in a stronger position than they ever were before.

HALFPENNY FARES.

West Ham and Walthamstow Decisions.

At the February meeting of Walthamstow Urban Council the Light Railways Committee, on the advice of Mr. W. Murray, general manager, recommended the abolition of halfpenny fares, an increase in the price of workmen's tickets by 50 per cent., the discontinuance of ordinary return tickets on the Chingford Mount route, and slight revisions in the ordinary fares. The recommendations were agreed to after the Council had rejected three amendments. One amendment was for the continuance of halfpenny fares on the ground that the omnibus company were not likely to follow the example of the Council. Another member sought to delete the clause for increasing the workmen's fare; the third amendment proposed to refer the whole matter back for further consideration, although it had been under discussion for several months.

On February 22, West Ham Corporation considered a recommendation by the Tramways Committee to abolish the halfpenny fare and to put into operation the following fares:—(1) Universal 1d. fare for a continuous journey on any one car; (2) 1½d. workmen s return fare for a continuous journey on any one car; (3) existing through fares where necessary to be adjusted to comply with the foregoing alterations; (4) children's fares to remain as at present. The committee based their recommendation on a report prepared by Mr. J. S. D. Moffet, general manager, showing that although halfpenny passengers constituted 47 per cent. of the total carried during the twelve months ended March 31, 1915, the receipts only represented 28 per cent. of the total revenue, and the loss on the carriage of these passengers amounted to £14,200. The loss was recouped out of the returns from passengers paying higher fares. Similarly for the year ended March 31, 1914, the loss on this class of traffic amounted to £20,000, £10,000 of which was borne by the rates, £4,000 by the reserve fund, and the balance by passengers paying higher fares. Unfortunately the Council, by 29 votes to 15, rejected the committee's recommendation, and decided to further consider the matter in committee.

LONDON EFFICIENCY MEETINGS.

The second of the efficiency meetings for the officials of the operating department of the Underground railways and London General Omnibus Group took place at Electric Railway House, Westminster Broadway, Mr. H. E. Blain, operating manager, presiding over a representative attendance, which included, on the omnibus side, Mr. J. P. Thomas (general superintendent), Mr. H. Lansdown (assistant general superintendent), and Captain A. Rozier (superintendent of employment); and on the railway side, Mr. W. E. Blake (superintendent of the line), Mr. S. J. Webb (railway passenger agent), and Mr. A. W. Agnew (mechanical engineer).

A paper on "A Parcels System on the Underground Railways" was read by Mr. H. J. Carter, chief parcels clerk to the Central London and City and South London Railway. The paper, which was illustrated with maps showing the areas covered by the parcels arrangements and charts depicting the results over a period of years, dealt chronologically with the parcels organisation since its commencement on the Central London Railway in July, 1911. Collecting, booking, accounting, and delivery methods in operation were described, and the advantages and difficulties carefully discussed. The discussion was of an exceedingly practical character, one of the speakers giving a tabulation of the results obtained in regard to time, cost, etc., in relation to parcels sent on the Underground Railways and by other methods.

A Device to Assist Motormen.—There is no doubt that the most effective way to render tramcars invisible to raiders is to shade the lights and to varnish the lamps, as is done in London and in many other places. In some localities, however, all the windows are fitted with blinds, which are kept drawn down. This method has the disadvantage of preventing a motorman from seeing the conductor's platform, a necessary precaution against accidents. To overcome the difficulty in Sunderland, Mr. A. R. Dayson, tramways manager and electrical engineer, has installed a step with a light spring on the rear platform, so that when passengers enter or depart the action of the step illuminates the electric bulb at the motorman's end.

BRITISH RAILWAYS IN 1915.

The leading British railway companies have published their reports and held their annual meetings in respect of the year 1915, and it is now possible to take a useful survey of their results for that period. They have, of course, remained under Government control throughout the year, whereas in 1914, by Order in Council, they were taken over by the Government as from August 5, 1914. Whilst the entire railway system of Great Britain is thus placed at the disposal of the Government for naval and military purposes, the actual administration remains in the hands of the Railway Executive Committee, composed of the general managers of the leading railway systems, presided over by Sir Herbert Walker, the general manager of the South Western, as acting chairman. The railways of Ireland, and the "tube" systems in London, are outside the Government arrangement, and they are the only companies, consequently, which are in a position to publish complete accounts for 1915. Curiously enough, in most of these cases, improvement is shown in their position, although they have had no assistance from the Government in the way of guarantee of net revenue, or any assistance in meeting special expenditure on war bonuses, and increased working expenditure generally.

The original financial arrangement between the Government and the "controlled" railways was revised early in the past year, and again modified later in the year. The net result of these changes is that the companies are practically guaranteed net revenue equal to the aggregate net revenue of 1913, less one-fourth of the war bonus granted early in 1915 to all members of their staff within the Conciliation Scheme.

We append a complete table of British railway results for the past three years. This table shows the dividends for the pre-war year 1913, for 1914 (when practically half the year was under normal conditions and the other half under war conditions), and, also, for the year 1915, when war conditions prevailed throughout. On the whole, this table indicates no very serious shrinkage in dividends as compared with the pre-war year 1913. Taking a few of the leading companies, we find the London and North Western has certainly reduced its dividend since 1913 from 7 to 6, and the Great Western from 6¼ to 5¾; but on the other hand, the Midland Railway has only reduced its Deferred Ordinary Dividend by one quarter, and the North Eastern has only reduced its Ordinary Dividend by one half. In all these cases, reference to the figures relating to reserves and balances carried forward, also included in our table, shows that they have been substantially increased, and particularly so in 1915. There is quite enough evidence in this table to show that the financial position of the British railways has been more fully maintained than that of any other railway system in any other country, in spite of the disastrous war conditions. There is also abundant evidence that the arrangement between the Government and the companies has been an excellent one from the public point of view, and has resulted in an enormous amount of service to the State being rendered at less cost than would have been possible had the companies charged in the usual way for their services. In numerous minor directions the railways have also been able to serve the public. Their steamers and harbours have been at the disposal of the Government, and have been freely utilised, and their valuable workshops have also been largely utilised for munition work.

The form of accounts adopted for 1914 and 1915 has been specially adapted to war conditions, as approved by the Board of Trade, and, consequently, lacks a good

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many of the usual details. There is one account appearing in every company's report, however, which is well worth careful study; we refer to the General Balance Sheet (No. 18). In the case of all the leading companies, the balance sheet shows a marked improvement, and the aggregate reserves and additions to the Depreciation Funds, etc., of the leading companies, provided out of the profits of the past year, represent over four millions sterling. To a considerable extent this represents provision for renewals, etc., which have been delayed by shortage of labour and materials. Various companies, in their auditors' certificates attached to their accounts, have called attention to claims against the Government in respect of deferred maintenance and renewals. Some companies have omitted reference to this matter, but in the great majority of cases such a claim exists, and, according to the addresses of various railway chairmen at recent meetings, the claim has been admitted in principle; indeed, we understand that—subject to proper investigation—these claims will be paid by the Government, plus an allowance for increased cost in carrying out such work, owing to present enhanced cost of labour and materials. There is another claim which has arisen, and has been referred to at various meetings; we refer to the interest on capital expenditure incurred since the year 1913. No provision was made for such interest on this outlay in the original arrangement between the Government and the companies: here, also, the claim is likely to be met. No credit is taken in any of the balance sheets in respect of these two important claims. The position of the companies after the war is, of course, a matter of considerable uncertainty, but the strong position reflected in their general balance sheets, and the payments still to be made by the Government in meeting the claims referred to, will provide some means of helping them to confront the difficulties that may arise.

Many thousands—about 150,000 railway men—have already enlisted in some branch of the fighting services, and this has proved a serious difficulty, considering the abnormal demands made upon the railway system. This outstanding fact must be taken into account, and, all things considered, the heavy requirements of the Government, and the normal demands of the trading and travelling public, have been met with a degree of efficiency hardly to be anticipated, even from so ably administered a railway system as that of this country. There is another striking fact, viz., the railway service for the public is practically the only service which, under war conditions, has not involved an increased charge to the public. Bearing in mind the prevailing widespread advance in prices, to say nothing of the alarming advance in shipping freights, this is perhaps the most remarkable feature at the moment. In looking round for new methods of raising revenue for the public, and, indeed, increasing the so-much-to-be-desired economy, the Chancellor of the Exchequer could scarcely do better than raise goods and mineral rates by, say, 10 per cent. Such a charge at the present time would raise a considerable revenue for the Government without any appreciable cost of collection, and at the same time provision would be made for meeting the additional cost of war bonuses, higher price of coal, and material included in the working expenses.

BRITISH RAILWAY RESULTS FOR THE PAST THREE YEARS.

Railway.	Stock.	Dividends. 1915	1914	1913	Reserve, &c. 1915	1914	1913	Carried forward. 1915	1914	1913
					£	£	£	£	£	£
Alexandra Dks. and Railway	B. Pf. ...	4½	4½	4½	12,124	6,500	19,773	11,959	12,508	12,276
Barry	Ord. ...	9½	9½	10						
,, ...	Def. O. ...	5½	5½	6				6,874	3,333	4,298
Brecon and Merthyr ...	2 Pf. ...	2	2	4	5,000	7,000	4,000	1,677	956	1,375
Cambrian	D. Deb.	4	4	2½	10,000	10,000	3,500	11,372	15,054	8,134
Cardiff	2 Pf. Ord.	3	3	3						
,, ...	Ord. ...	1	Nil.	1				11,306	17,513	7,383
Central London	Ord. ...	3	2½	3				15,685	15,413	20,878
City and S. London ...	1901 Pf ...	5	2½*	2½						
,, ,, ...	1903 Pf....	5	2½*	5*				9,027		738
Cleator and Workington ...	Ord. ...	4	3½	4½				860	505	187
Furness	Ord. ...	2	1	2½				12,265	1,804	1,898
Great Central	1889 Pf....	4	4	4						
,, ,, ...	1891 Pf....	4	4	4						
,, ,, ...	1894 Pf....	1	Nil.	2				7,214	7,675	8,700
Great Eastern	Ord. ...	2½	2½	2½	10,000	10,000	10,000	108,949	108,909	111,146
Great Northern	Ord. ...	4½	4½	4½						
,, ,, ...	Pf. Ord.	4	4	4						
,, ,, ...	Def. Ord.	2½	2½	3		60,000	60,000	128,325	101,006	130,796
Great Western	Ord. ...	5½	6	6½	200,000	200,000	200,000	160,000	115,601	128,780
Hull and Barnsley ...	Ord. ...	2	2	3½			5,000	8,470	11,507	16,244
Isle of Wight	Def. Ord.	2½	2½	2½					2,024	1,916
Isle of Wight Central ...	1 Pf. ...		3½	4					822	1,007
Lancashire and Yorkshire...	Ord. ...	4½	4½	4½		20,000	20,000	40,374	45,999	40,780
Liverpool Overhead ...	Ord. ...	3½	3	3	4,400	4,400	4,400	6,873	7,013	6,275
London and North Western	Ord. ...	6	6	7	200,000	100,000	100,000	174,574	109,003	101,927
London and South Western	Ord. ...	5½	5½	5½						
,, ,, ,,	Pf. Ord.	4	4	4						
,, ,, ,,	Def. Ord.	1½	1½	1½		20,000		59,470	52,623	42,599
London Brighton	Ord. ...	5	4½	5½						
,, ,, ...	Pf. Ord.	6	6	6						
,, ,, ...	Def. Ord.	4	3½	4½				37,398	39,994	33,362
London, Chatham & Dover	Arb. Pf.	4	4½	4½				85,989	73,093	85,934
London Electric	Pref. ...	4	4	4						
,, ,, ...	Ord. ...	1½	½	1	20,000	8,000	8,000	12,303	11,547	1,086
Maryport and Carlisle ...	Ord. ...	5	5	6½	6,500			2,294	2,244	1,419
Metropolitan	Ord. ...	1	1½	1½	15,000	12,500	7,500	13,041	11,458	8,258
Metropolitan District ...	2 Pf. ...	3	2	2½	35,000	20,000	20,000	13,952	13,888	12,659
Midland	Pf. Ord.	2½	2½	2½						
,, ...	Def. Ord.	4	4	4½	200,000	200,000	200,000	142,339	131,442	141,329
Midland and S.W. Junction	B. Deb.	½	½	½				343	343	343
Neath and Brecon	Pref. ...	2½	2½	3½				2,111	79	243
North Eastern	Ord. ...	6½	6½	7	230,000	150,000	300,000	257,163	189,774	134,947
North London	Ord. ...	3½	3½	4½	5,000			8,138	6,223	6,917
North Stafford	Ord. ...	4½	4½	5	10,000	8,000	8,000	15,331	12,459	10,842
Port Talbot	Ord. ...	9	9	9				3,401	2,615	2,318
Rhondda and Swansea ...	Ord. ...	5	5	5				2,294	1,658	591
Rhymney	Ord. ...	8½	8½	9	2,000	4,000	6,000	2,915	3,724	3,237
South Eastern	Ord. ...	3½	3½	4						
,, ,, ...	Pf. Ord.	6	6	6						
,, ,, ...	Def. Ord.	1	1	2				3,014	7,817	4,199
Stratford and Midland ...	Ord. ...	—	1½	1½					734	504
Taff Vale	Ord. ...	3½	3½	4				19,958	14,021	9,174
SCOTLAND.										
Caledonian	Ord. ...	3½	3½	3½				29,294	22,307	22,081
,, ...	Pf. Ord.	3	3	3						
,, ...	Def. Ord.	½	½	½						
Glasgow, S.W.	Pf. Ord.	2½	2½	2½						
,, ...	Def. Ord.	1½	2	2½				18,722	21,973	11,022
Great North of Scotland ...	Pf. Ord.	3	3	3						
,, ,, ...	Def. Ord.	1	1	1½				6,683	8,159	9,039
Highland	Ord. ...	2½	2½	2½	4,000	2,000				16,713
North British	Pf. Ord.	3	3	3						
,, ,, ...	Def. Ord.	½	1	1½	20,000	20,000	40,000	32,189	34,195	48,804
IRELAND.										
Belfast and County Down ...	Ord. ...	6½	6½	6½	6,500	9,000		12,540	8,937	5,920
Cork and Bandon	Ord. ...	2½	3½	3½	1,620	2,500	2,500	4,467	3,827	3,530
Dublin and S.E.	Pref. ...	4	4	4						
,, ,, ...	Ord. ...	Nil.	½	1	5,000		8,000	10,020	12,463	10,232
Great Northern	Ord. ...	5½	5½	5½				65,020	60,460	44,723
Great S. and Western ...	Ord. ...	5	5	5			50,000	104,470	69,900	53,071
Mid. Gt. West.	Ord. ...	2	2	3		10,000		20,020	17,133	7,038

* Partly out of capital. † From reserve.

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LONDON TRAFFIC IN 1913.

FROM A CORRESPONDENT.

The paper by Sir Albert Stanley on the above subject, which was presented at the International Engineering Congress held at San Francisco, and was published in THE TRAMWAY AND RAILWAY WORLD of February 10, affords much interesting information on the subject dealt with.

The author referred to the large increase in passengers carried by the London General Omnibus Company (taking the years 1911 and 1913) in comparison with that obtained by the London County Council, the figures being :—

London General Omnibus ... ... 107 per cent.
London County Council ... ... 1·3 per cent.

Further interest would have been afforded to those engaged in the transportation business if the article had contained information as to the number of omnibuses and miles run by the L.G.O., but these important details have apparently been studiously omitted. There is no doubt that a very large proportion of the 107 per cent. increase in the number of passengers carried has been due to the following causes :—

(1) To the persistently aggressive competition carried out by the L.G.O. against the London County Council and other Metropolitan tramway systems during the year mentioned.
(2) To the very considerable increase in the number of services operated, comparing 1911 and 1913.

In connection with this large increase in passengers carried it will be interesting to recall that it was stated in evidence before the Select Committee on Motor Traffic that the receipts per omnibus per annum had fallen from £1,508 in 1910 to £1,107 in 1913, a falling off of £400 per omnibus, and that the passengers had also fallen from 268,000 to 208,000, a decrease of 60,000 passengers per omnibus. It was admitted that if the omnibuses had been carrying as many passengers for the year 1913 as they were carrying in 1910, that "700 *fewer omnibuses* could have been done with."

This surely was a somewhat startling admission to make, and one that would appear to indicate that the real and only causes for the large increase mentioned were to be found in the views expressed in the foregoing paragraphs, and especially as far as No. 1 is concerned. What a needless expense have the authorities in the Metropolitan and adjacent areas been put to by the wholly unnecessary wear and tear of the roads by "the 700 fewer omnibuses which could have been done with."

With reference to the average receipt per L.G.O. passenger being 1·33d., and in comparison with that of 1·01d. per L.C.C. passenger, and to the statement that "Tramways are practically excluded from the central area for reasons based on the narrow thorough-fares," it is only by reason of this exclusion of tramways that the L.G.O. derive their higher average. The vast majority of the L.G.O. services—at one period of operation all but 15 out of 93—traversed through *some* portion of the central area, better known, perhaps, in some quarters as the "'Bus Paradise," and where the L.G.O. big dividends are undoubtedly earned.

Where omnibus routes coincide with tramway routes the rates of the various stages are practically identical. Passengers in the central area are in the habit of jumping on omnibuses for very short rides, chiefly owing to the difficulty of walking along the greatly congested pavements. In a large number of cases the distance ridden does not exceed a quarter of a mile, so that for the penny minimum fares—in comparison with the halfpenny fares charged on the L.C.C. cars—passengers are paying the L.G.O. at the apparent extortionate rate of 4*d. per mile*. In many instances the distance ridden does not exceed half-a-mile, when, similarly, the rate per mile is 2d., whilst those who ride for one mile pay at the rate of 1d. per mile.

The L.G.O. make no attempt to accommodate in respect of equitable fares these "short ride" passengers in the area where they have a monopoly. Had the L.G.O. average receipt per passenger been similar to that of the L.C.C., their revenue for the year under review would have been *less* by £749,508, and their profit of £296,758 would have been converted to a *loss* of £452,750. How extortionately are the omnibus passengers paying for the blessings of 'bus services.

It is thus clear why the L.G.O. average *is* greater than that of the L.C.C. At the same time, however, it is equally clear that, ***unless*** the L.G.O. obtained the all-round higher average, principally contributed in the central area (which is so far closed to the L.C.C., who would give cheaper fares), and considered to be far higher than that obtained by any other omnibus or tramway undertaking, they would be quite unable to charge the same fares as the tramways do where they are in competition with them.

The author refers to the comparative operating expenses per passenger for both undertakings, the figures being :—

London General Omnibus ... ... ·94d.
London County Council ... ... ·73d.

Included in the latter is, of course, a proportion in respect of track repairs. No allowance is included in the L.G.O. figures in respect of road maintenance ; if, therefore, a figure for such a charge was included, taken on the basis of three-eighths of a penny per omnibus mile, or such other charge as the Legislature has already imposed on motor omnibus operators *outside* the Metropolitan area, the expense per L.G.O. passenger would have been increased. As the figures are not on the same basis, they are, obviously, not strictly comparable.

When comparing the net result per passenger from omnibus and tramway operation :—

London General Omnibus ... ... ·39d.
London County Council ... ... ·28d.

it will be found that the former, notwithstanding their high average receipt per passenger, gain but a very small advantage over the L.C.C., the figures being 29·32 per cent. and 27·72 per cent. respectively. These figures prove that in view of their increased cost of operation the L.G.O. cannot afford to give the same facilities as those of the L.C.C.

London is not, as some would have us believe, pre-eminently the city of cheap transit ; it is, on the contrary in fact, the city of most expensive transit. This fact has never yet been adequately realised, and its consequences have not been in the least appreciated, because Londoners, instead of comparing the transit facilities with those of other towns—especially in some of the larger cities of the provinces—are content to pride themselves on the improved facilities they now enjoy in comparison with those they had to put up with ten or twelve years ago.

Reference is also made to the relative efficiency of the motor omnibus in comparison with that of the tramcar. It cannot be disputed that the tramways are the best means of conveying cheaply large numbers of people along the street. The public, as travellers, especially in the matter of fares, or ratepayers, in respect of the maintenance of the roadways used, derive more advantage from the operation of tramways than from any other form of surface transport.

The mobility of the motor omnibus is all very well, but what about the greater utility of the tramcar and its admittedly superior advantages in handling large volumes of traffic ? Can anyone imagine what the Embankment, for instance, would be like if motor omnibuses superseded the tramway car and had to handle the heavy traffic that is so effectively dealt with by that vehicle ? During slack hours of service the tramcar carries very much the same number of passengers as is carried by the omnibus at the same hours ; but when the traffic demands it, the tramcar provides 78 seats as compared with 34 by the omnibus.

Assuming it were economically possible for the omnibus to expand its services to meet the requirements of the traffic at the busy hours, the effect of the congestion in the streets would be very serious, and accidents would be very largely increased, as the omnibuses, for the carriage of a given quantity of traffic, would certainly occupy much more road space than the tramcars. A tramway car is 33 feet 10 inches in length, carries 78 persons, and a motor omnibus, 23 feet in length, carries 34 ; so that, obviously, two omnibuses would not carry as many persons as one tramcar. Allowing for the distance of 15 feet between the two omnibuses, the latter would occupy 61 feet of the street in comparison with 33 feet 10 inches occupied by one car carrying a somewhat larger number.

If the L.C.C. cars were entirely withdrawn, and the same seating accommodation had to be provided by omnibuses, as is now provided by the cars, 3,109 omnibuses, or an increase of 114 per cent. of vehicles over the number of tramcars, would be required during fine weather, whilst during inclement, when only inside seats of omnibuses are usable, 7,513 omnibuses, or an increase of 418 per cent., would be required. The effect of such a condition of affairs on street congestion and public safety would be appalling.

Take the L.C.C. Walworth route under normal conditions of working as a typical example. During the busy hours of each weekday not less than 80 omnibuses and 111 tramcars pass a given point in Walworth in one hour. If the electric cars were withdrawn, and the same accommodation were given by omnibuses, the result would be, on a dry morning, 318 omnibuses an hour, and on a wet morning, 655 omnibuses an hour. When these observations were taken there was a car every 128 yards ; with 318 omnibuses there would be one of these vehicles every 44 yards, whilst with 655 there would be an omnibus every 21 yards in each direction.

Again, a tramcar, with its great seating capacity, would cause much less obstruction in proportion to each passenger carried than any other vehicle using the streets. When the maximum service of cars is in operation, 542 cars an hour pass through the Elephant and Castle junction of routes. If omnibuses were used instead 1,162 of these vehicles an hour, *in addition* to the present omnibus service, would be required to give the same accommodation in fine weather, and 2,808 additional omnibuses an hour would be required in inclement weather.

With such a condition of affairs resulting from the possible operation of the greatly increased omnibus services, the streets would be totally unsafe for pedestrians, whilst the increased congestion would be too serious to contemplate.

The omnibuses do not perform in many ways the public services rendered by the tramways, yet they nevertheless contribute more materially than any other form of traffic to the danger of the public, and to the excessive wear and tear of the roadways, and for which, so far, they have escaped demands for contribution.

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WOMEN AS DRIVERS.

THE GLASGOW EXPERIMENT.—LONDON SUGGESTION OPPOSED.

At a meeting of Glasgow Corporation on February 17, Councillor Montgomery, chairman of the Tramways Committee, was asked whether the experiment with women car drivers had been a success. Councillor Montgomery replied that the practice of the tramway department was to allow 30 days for motormen to qualify, and that course had been followed in the case of the women. That period had almost expired, and the experiment had been successful. The number of accidents with women drivers was not more than with men. A number of women had given up their situations as drivers, but not for the reason suggested, viz., that the work was too hard.

For some time the London police have been urged to license women as drivers of motor cabs in order to make good the shortage in those vehicles. The suggestion, however, does not find favour, mainly because the male drivers have enlisted under a pledge that their places would be kept open for them. On February 20 a meeting of the London and Provincial Union of Licensed Vehicle Workers, which includes some of the London female conductors, met at Euston Theatre and passed a resolution "protesting against the licensing of women to drive cabs, omnibuses, or tramcars, especially in view of the fact that there was no shortage of drivers, and that tramcar and omnibus drivers are classified in reserved industries." The resolution also expressed determination to assist the Government to bring the war to a successful issue, and instructed the officials to take steps to resist the introduction of women as drivers. No reliance is to be placed on reports that the Public Carriage Department at Scotland Yard are seriously considering the question of licensing women as tramcar and omnibus drivers. So far as can be ascertained it is a suggestion regarding motor cabs that has disturbed the Vehicle Workers' Union.

Several additional women are being trained as tramcar drivers in Doncaster.

WOMEN CONDUCTORS.

Nearly 300 women are at work or in training as conductors on the London County Council cars. Their presence is no longer restricted to the single-deck vehicles. They are to be seen on the double-deck single truck cars, on the trailers, and in pairs on bogie cars. Their uniform is probably the neatest to be seen on any traffic undertaking, comprising as it does a dark grey coat, skirt, and gaiters, and a black mackintosh hat with a brim all round. On the collar of the coat are the initials L.C.C.

The London United Tramways have nearly 100 female conductors at work. In the northern outer suburbs the Metropolitan Electric Tramways management employ women to the number of one-third of the conductors. Women conductors have also been introduced on the South Metropolitan cars. The Underground Railways employ 150 women as conductors, and 200 more are working as ticket collectors, booking clerks, porters, and lift attendants.

Thomas Tilling's Omnibus Company by the end of February were no longer the only London motor omnibus undertaking employing women to collect fares. The London General Company have had 70 in training for two weeks past, and are advertising for further candidates, although there is a choice of over 300 applicants a day. A large number of women conductors will be required, owing to several hundred men being about to join the army under the Derby recruiting scheme. Over 6,000 employees of the allied companies have already gone to the war. The women's uniform will comprise a long Norfolk jacket of blue cloth, trimmed with white piping, skirt of the same material reaching just below the knees, long cloth and leather gaiters, boots with low heels, blue soft felt "Alpine" hat with upturned brim at one side, trimmed with white piping, and L.G.O.C. badge and a mackintosh.

The *Manchester Guardian* records a great improvement in the manners of the trolley and bell boys on the tramcars, and attributes the change to the presence of the women conductors.

COUNTY COUNCILS AND ROAD MAINTENANCE.

NOT AN "OPPORTUNE TIME" FOR A JOINT COMMITTEE.

The Executive Council of the County Councils Association recently communicated with the Local Government Board pressing for the appointment of a joint committee of both Houses of Parliament to consider the question of the contribution by owners of motor omnibuses towards the upkeep of the roads traversed by those vehicles. Just prior to the war Mr. H. Samuel, President of the Board, promised to secure the appointment of such a committee.

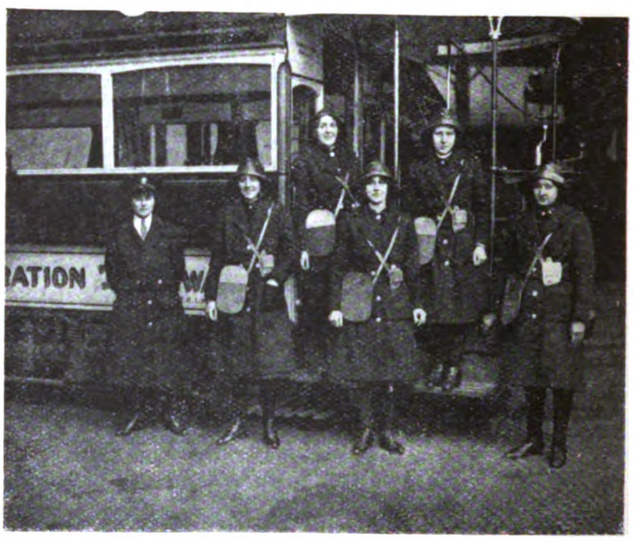
At the annual meeting of the association on February 23, it was reported that Mr. Long, the new President of the Local Government Board, had forwarded a reply stating that he did not consider the present an opportune time for the appointment of the committee.

The report presented by the Executive Council mentioned that during the year the Highways Committee had considered the question of empowering county and county borough councils to make regulations with regard to motor omnibuses, motor chars-a-bancs, and similar vehicles plying for hire. They had also conducted negotiations with the Road Board and the Treasury in regard to grants and schemes, one result of which had been that the Treasury agreed to modify its decision that no grants from the Road Improvement Fund should be allowed for the year 1915-16, except for works already agreed to before the outbreak of war or required to meet serious unemployment.

One of the outstanding events of the year was "the appointment, as a result of the urgent representations made by the association, of the Departmental Committee on Locomotives and Heavy Motors (Damage to Roads), and the submission of detailed evidence by seven witnesses on behalf of the association."

CONDUCTORS' WINTER UNIFORMS.

The two photographs on this page show the two varieties of uniform supplied to the young women conductors and the inspector employed by Southampton Corporation Tramways Department.



Southampton Conductors Equipped for Rain.

Winter Uniforms for Fine Weather.

In the first picture the employees appear in overcoats and south-westers; the second depicts the fine-weather clothes. For each outfit there is a skirt, breeches, and puttees.

MOSCOW TRAMWAY REQUIREMENTS.

Moscow Council will shortly consider a proposal to add to their tramways rolling stock and to make an extension of the system. New workshops are to be built, and the total cost is expected to exceed one million roubles (£106,250). The Town Executive Committee proposes that the Council should buy American cars on easy terms, i.e., on the instalment plan—to the extent of 100 motor cars and 150 trailers.

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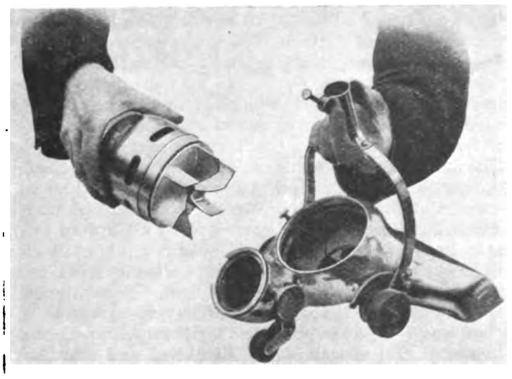
THE PREMIER ELECTRIC SUCTION CLEANER.

The Electric Suction Cleaner Company, of 56, Victoria Street, London, S.W., have made several notable improvements in their "Premier" electric cleaners for domestic service, and they have recently introduced a type of cleaner for industrial use that should find wide application in offices, workshops, stores, and tramway and railway car depots. The device has been found effective for switchboards, and is specially useful for cleaning filter cloths in turbine stations. By means of a specially-designed belt the machine



Motor and Fan Removed from Head of Cleaner.

and receptacle for the dust can be attached to the waist of the user, thus leaving both hands free, so that it can be used at the top of the ladder, or, if preferred, the cleaner can be carried by a substantial handle, as shown in the illustration below.

The machine consists of a high-speed vertical motor and fan contained in an aluminium case, and in its electrical features is similar to the "Premier" cleaner for domestic work. Special

Premier Electric Cleaner Attached to Belt of User.

attention has been paid to the designing of the blades of the fan, so that they might be given the best and most accurate form. The motor and fan are held by two set screws which permit the motor to be taken out and replaced by another in a few seconds. Careful tests by independent experts show that the suction in the domestic machine is equivalent to a little more than 10 in. water gauge, and it is still higher in the industrial machine. The motors are made for any voltages from 25 to 260, and from all periodicities from 25 to 133.

TRAMWAYS UNDER THE MUNITIONS OF WAR ACTS.

The following form (M.M.I.) has now been issued, and may be obtained by application to the Ministry of Munitions :—

Application to the Minister of Munitions to certify, in accordance with Section 9 (1) (d) of the Munitions of War (Amendment) Act, 1916, that the supply of tramway facilities by the undermentioned undertaking is of importance for the purpose of carrying on munitions work.

(1) Title and address of undertaking making application.
(2) Route mileage of the system.
(3) Total number of cars in service on an average weekday.
(4) Number of such cars (if any) which are necessary and used for the carrying of workpeople.
(5) Total number of cars in service on Saturdays.
(6) Total number of passengers carried on an average weekday.
(7) Average number of workpeople carried on an average weekday.
(8) Any estimate available of the number of munition workers included under (7).
(9) Average number of passengers carried on Saturdays.

NOTE.—The answers to questions (3) and (9) should be based upon the figures at the present period of the year.

(10) Number of tramway employees affected by the application.

Traffic Staff—
1. Drivers.
2. Conductors.
(a) Male.
(b) Female.
3. Other traffic employees.

Car Repair Shops—
1. Skilled men.
2. Semi-skilled men.
3. Labourers.

Permanent Way—
1. Skilled men.
2. Semi-skilled men.
3. Labourers.

Power Station—
(If the tramways undertaking supplies its own power).
1. Skilled men.
2. Semi-skilled men.
3. Labourers.

Car Sheds—
1. Skilled men.
2. Semi-skilled men.
3. Unskilled (a) men.
(b) women.

Electrical Equipment—
(Linesmen, etc.).
1. Skilled men.
2. Semi-skilled men.
3. Labourers.

(11) Is it claimed that the whole of the tramway routes are used by and are necessary for the carrying of munition workers to and from their work ?
If not, state what portion of the tramway routes it is claimed should be certified.

(12) Is it claimed that the whole of the cars in daily service (including Saturdays) are necessary for carrying munition workers to and from their work ?
If not, state how many cars it is claimed are necessary.

(13) A map should be sent showing by distinctive colour—
(a) The tramway system which, it is claimed, should be certified.
(b) The principal munitions factories directly served by the undertaking.

(14) Give a list of the principal munitions factories served directly by the undertaking. (This should correspond, as far as possible, with those shown on the map referred to in the previous question.)
List of principal munitions factories served.

RESERVED OCCUPATIONS.

The following revised list of reserved occupations in connection with public utility services has been issued by the Board of Trade, together with a list showing the alterations made in the general reservations affecting all trades.

PUBLIC UTILITY SERVICES.

Electrical Generating Stations (including those for tramways and electric railways).—All classes of workmen.

Fire Brigades and Salvage Corps.—Men solely employed in connection with public fire brigades and salvage corps not to be called up without the consent of their chief officer.

Gasworks.—All classes of workmen inside the works.

Omnibuses.—Head of department ; foreman ; motor driver.

Tramways.—Traffic inspector ; driver ; chief storekeeper ; parcel superintendent.

Waterworks.—All classes of workmen engaged in the provision and distribution of water.

ALL INDUSTRIES.

Mechanics, etc.—Mechanics and other similar men engaged in the maintenance and repair of plant, machinery, and tools.

*Carters, Lorrymen, and Draymen (horse or power).—Employed by public carriers of goods by road, or by carting contractors in connection with railways, docks, wharves, and warehouses. Others, in all trades, not engaged in collecting from or delivering to private houses.

Coopers.—All classes (except those employed in making or repairing barrels or casks for beer, wine, or spirits).

NOTE.—The above refers to the Military Service Act, 1916.

* These reservations are in addition to the reservation of carters, lorrymen, and draymen under specified trades, viz., coal depots or wharves, flour mills, and in the home-grown timber trade.

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STEAM RAILWAY ELECTRIFICATION.

Lancashire and Yorkshire Expenditure.

The annual report of the Lancashire and Yorkshire Railway Company shows, under the heading of capital account, the expenditure on the Liverpool to Southport, Manchester to Bury, and Bury to Holcombe Brook sections, which have been converted to electric working. On power stations, etc., the outlay up to December 31, 1914, was £392,804, and during 1915 £112,871 was expended, making a total of £505,676 on this head. Estimated further expenditure on capital account included £17,500 during the current year on the electrification of the Manchester and Bury line, and £6,500 subsequently; and £28,400 on electric power stations, etc., during 1916, and £5,500 subsequently. Under the heading of rolling stock, the particulars respecting trains worked by electric power, showed that the number of cars had increased during the past year from 174 to 210, and the carrying capacity from 13,616 seats to 16,552 seats.

Sir George Armytage, chairman of the Lancashire and Yorkshire Railway, stated at the annual meeting that the electrification of the Manchester and Bury line was almost complete, and at an early date the electric service would be instituted. When the full service was running it would be equal, if not superior, to any other service in the United Kingdom, both as regards speed and comfort. A full description of the work, accompanied by 56 illustrations, appeared in our issue of January 13.

London and North Western Suburban Scheme.

Particulars of the progress of the above work in the London area were given in the report of the engineer, which was included in the statement of the directors of the London and North Western Railway for the year ended December 31, 1915. The report mentioned that the bridges and tunnels for the junctions between the new electric lines and existing lines to Euston and Broad Street are in progress, and half the length of the iron-lined tunnels under Primrose Hill has been completed. The electric power station and repair shed at Stonebridge Park and six electric sub-stations are complete, and part of the plant has been installed, and the equipment of the new lines for electric traction between Willesden and Watford is in a forward state. The electrical equipment of the North London, Hampstead Junction, and North-South Western Junction lines, which form the through route between Broad Street in the City and Kew Bridge and Richmond, is being proceeded with, and the buildings for the sub-stations on these lines are complete.

Additional information was afforded by the speech of Sir Gilbert Claughton, Bart. (chairman), in moving the adoption of the report at the annual meeting on February 25. He stated that on the capital account they had expended during the year £832,462, including £143,500 advanced to the London Electric Company as part of the £1,000,000 which they agreed to lend that company in connection with the construction of the new extension of their line from Paddington to Queen's Park, the total amount now advanced being £542,416. Of the total amount expended on capital account £651,625 was in connection with the Euston and Watford Electric Railway. The further amount estimated to be expended this year was £928,000, of which £630,000 was in connection with that railway. The extension of the Bakerloo Tube to Queen's Park was opened in February of last year, and, pending the opening of the through route to Watford, arrangements were made whereby certain of the tube trains had, since May last, run through from Queen's Park to Willesden, where connection was made with main line and local London and North Western trains. If certain existing difficulties could be overcome, it was hoped to begin running electric trains between Broad Street and Kew and Richmond as from September.

North London Railway.

Further information relating to the electrification of the North London Railway was given in the remarks of Lord Rathmore (chairman) at the annual meeting on February 24. The work, he said, was part of the greater scheme for the conversion of the London and North Western suburban lines, but delay had arisen owing to the difficulties in obtaining electrical plant, and also with respect to technical labour difficulties, due principally to the war. Until the line was freed from the Government trains that now had to pass over it, they could hardly do more than work the existing services electrically. A more frequent service would be constantly interfered with. It was to the ultimate interest of the company that the electric service, when once started, should above all things be reliable, and not subject to interruption and consequent disappointment of the public. If the difficulties to which he had referred could be overcome as regarded the North London Railway, it was hoped that they might by September next be able to work the present services between Broad Street and Kew and Richmond by means of electric trains. It was to electric traction and the quicker and more frequent services that they would thus be enabled to provide—especially in the case of the through service between Broad Street and Watford—that they must look for a return in some measure of the great prosperity their railway formerly enjoyed.

L.B. and S.C. Suburban Lines.

The Earl of Bessborough made a gratifying announcement respecting the suburban electric railways of the London, Brighton, and South Coast Company at the annual meeting on February 23. He said that the main item of capital expenditure last year was the sum spent on the equipment of the suburban lines for electrical traction. The war necessitated a temporary suspension of part of this work, as well as certain rearrangements with the contractors, which would have the effect of prolonging the period within which the work was to have been completed. They were now, however, steadily proceeding with it in the hope that when normal conditions returned the scheme to which the proprietors had given their approval might be sufficiently far advanced to enable them to obtain at once some part, at any rate, of the benefit they had every reason to expect. The electric services were working most satisfactorily and giving excellent results. Last year there was an increase in the number of passengers carried by those services of nearly 70 per cent. over those carried in the last years of steam traction, and since the inauguration five years ago over 40 millions more passengers had been carried. The increase continued, as was demonstrated by the fact that the number carried last year was 15 per cent. higher than in 1914.

In the course of the discussion, Mr. M. Long said he understood that the electrification had been entrusted to a German firm. He would like to know if the contract had been completed or annulled, and he would like to express the hope that no future work connected with the line would be given to a German firm. (Hear, hear.)

The chairman replied that the electrification contract to which Mr. Long had referred was made with the Metropolitan Carriage and Wagon Company, and Messrs. R. W. Blackwell and Company. He did not, however, say that no more equipment would be obtained from Germany by the company or its contractors, but that may be taken for granted, we hope, for all time.

London and South Western.

Sir William Portal, presiding at the annual meeting of the London and South Western Railway on February 25, remarked that up to the end of last year they had spent £970,000 on the electrification of the suburban services. (The work was fully described in our issue of November 18, 1915, the description being accompanied by 61 illustrations.) As a result of the war, progress had been very slow, and it was not until October last that they had been able to start the section of the line from Waterloo to Wimbledon, *via* East Putney. A month ago they opened the "roundabout" service *via* Richmond and Kingston and the Shepperton line, and early in March the service to and from Hounslow would be commenced. There only further remained the service to Hampton Court and Claygate, completing the whole of the scheme they had in hand. Three or four months might elapse before they would be able to electrify the last two remaining services. This was due to delay in the completion of the power house which had caused them to conduct their work under serious difficulties, and one of the results was that they were getting a certain amount of overcrowding in the electric trains on the "roundabout" services during the rush hours. Comparing the week just prior to the opening of the "roundabout" electric with the second week after the service commenced, there was an increase of 16 per cent. in the bookings.

LONDON ELECTRIC RAILWAYS.

Metropolitan Railway.—At the annual meeting of this Company on February 10, a shareholder asked if the company (which is not connected with the allied traffic undertakings) could not come to an arrangement with the competing omnibus companies.—The Chairman (Lord Aberconway) replied that the directors had tried in every possible way to induce other companies to put up their fares to a point which was reasonable and commensurate with the capital cost of the undertaking. That was the only way in which they could put up fares. Wherever their line went, there was a line of omnibuses going along the road, paying nothing for rates and having free use of the street, and keeping down fares to the lowest point. The County Council were the people most to blame. They ran their tramcars and cut the fares down to a ridiculous point. The motor omnibuses followed suit, and this company had to come in at the rear.

A dividend of 1 per cent. for the year on the ordinary stock was declared.

Central London.—At the annual meeting on February 24, Lord George Hamilton (chairman) referred to the agreement for constituting a common fund between this and other companies. The gross receipts of the company in 1915 were £316,527, an increase of 14·11 per cent., and the expenditure had increased by £12,164, or 8·43 per cent. The appropriation to reserve was £10,000, and they hoped to set aside a similar sum in future years. The capital expenditure of £35,440 was chiefly due to the new works in connection with the Ealing Extension Railway. The balance available for dividend was £105,685. An interim dividend of 1½ per cent. was paid on the ordinary stock and 2 per cent. on the preference ordinary stock, and the directors now recommended a further

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payment of 1½ per cent. on the ordinary shares, of 2 per cent. on both the preferred and deferred ordinary, leaving £15,685 to be carried forward.

London Electric.—Lord Farrer, presiding at the annual meeting on February 24, after explaining the pooling arrangement entered into by this and other companies, said that this company's proportion for the year under review was 26 per cent., and for 1916 it would be 30 per cent., unless unforeseen circumstances should make an alteration necessary. The gross receipts were £963,131, an increase of £181,186. A large part of this was due to the Queen's Park extension and to increased traffic on the Charing Cross extension, with its new arrangement of interchange escalators; and also to the general increase of traffic due to the reduced means of transit in the streets. The Queen's Park extension was a prolongation of the Bakerloo tube from Paddington to join up with the London and North Western Railway between Euston and Willesden. There was a 15-minute service from Willesden to the Elephant and Castle. It was proposed to extend this service to Watford when circumstances permitted. The expenditure had increased by £83,300. The balance available for dividend on the ordinary shares was £128,902, an increase of £59,055. An interim dividend of ½ per cent. had been paid, and the board now recommended the payment of a further dividend of ¾ per cent. This was a higher dividend by ¼ per cent. than had been paid before.

Metropolitan District.—In his remarks at the annual meeting on February 24, Lord George Hamilton (chairman) said that the expenditure upon the electrification had been very much larger, and the receipts during the earlier years of the change l system of working very much less, than was anticipated. The railway had been resuscitated entirely by the exertions of Sir George Gibb, Sir Edgar Speyer, and Sir Albert Stanley—who had brought the railway up until there had been an absolute change in every way—in its material condition, in the service it rendered, and in its financial position. The policy adopted might be summed up in two sentences—individual expansion inside and unification outside. In moving the adoption of the report, his lordship stated that their proportion of the common fund under the pooling arrangement was 12 per cent. If for any cause the takings of any company should not be sufficient for such purposes, the deficiency would become the first charge on the common fund. It would therefore be appreciated how very materially the position of the prior stocks of this company was improved by this agreement. The common fund for 1915 was no less than £451,000; in other words, the aggregate net earnings of the five companies must shrink by at least that amount before the interest on the prior stocks of the company could be affected, and this was a very unlikely contingency. In further remarks, the Chairman alluded to the increase in the dividend for the year on the second preference stock from 2 per cent. to 3 per cent., and referring to the staff he said that, generally speaking, the work which was being done by the women in the company's employ was satisfactory.—Sir Charles Dalrymple, Bart., seconded the motion.—Sir Robert Perks congratulated the management upon carrying such a large number of people—over 100,000,000, according to his estimate—during the past year, notwithstanding the undoubted difficulties which had had to be faced. The fact that the gross revenue now exceeded a million sterling seemed to mark a satisfactory step in the progress of the company. Ten years ago, when he last occupied the chair, they were looking forward to reaching that standard at a very much earlier date, and it had been a deep disappointment to all the ordinary stockholders, as well as to the Underground Company, which held so much of the preference stocks of this company, that they had had to wait so long for their anticipated return. To some extent this was due to the fact that they had not done what he, as chairman, in the Parliamentary Committee Rooms assured Parliament they were going to do, and what they obtained Parliamentary authority to do, namely, charge a reasonable figure, instead of the "cut-throat" prices they at present charged. He hoped this question would be seriously considered.—In reply, the Chairman said he might fairly say that they were approximating nearer and nearer to the period at which the possibility of a dividend on the ordinary stock might become likely. Meantime the ordinary stockholder, by the making of a considerable reserve, was benefited at the expense of the second preference. He wished to utter a word of warning on the question of fares. The District was now part of a great organisation which to a very large extent had control of the passenger traffic of London. In consequence of the District fitting into that organisation, its traffic had improved and its receipts had been augmented. They had to be very careful about raising fares, because if they raised them they would strike at the foundation of the success of the undertaking. They had arrived at their present position largely owing to the excellence and cheapness of the service. Looking, however, to the rise in the cost of petrol, coal, and wages, the time might come when in self-defence they would be compelled to raise their fares.

Stoppage at Birmingham.—The coal stocks at the power station having been practically exhausted because of the adverse weather interfering with the transport arrangements, the tramways service was suspended for an hour on February 28.

DUBLIN UNITED TRAMWAYS.

A Record Year.

The annual meeting of the Dublin United Tramways Company was held on February 8, Mr. W. M. Murphy presiding. The report recommended a dividend at the rate of 6 per cent. per annum, less income-tax, on the preference shares for the half-year ended December 31; a final dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary shares for the half-year; and that £18,000 be set aside towards renewal of rails, and £5,000 to reserve and renewals. The carry forward is £13,045. The financial statement was given in our issue of February 10, together with the corresponding figures for the years 1914 and 1913.

In moving the adoption of the report, the Chairman referred to the death of Mr. R. S. Tresilian, secretary; Mr. C. W. Gordon, manager; and Captain C. Colthurst Vesey, one of the directors. Mr. Tresilian was forty years in the tramway service of Dublin. He was a man of exceptional ability. Eighteen years' experience of Mr. Gordon, associated with him as he was, gave him sufficient opportunities to appreciate his fine qualities. He controlled at different periods undertakings owned by the Tramways Union (a London company) in European cities from Madrid to Bukarest. The late Captain Vesey as a director was most helpful. Mr. Laurence Waldron's accession to the board would greatly increase its strength. They would see in the report the rearrangements in the *personnel* of the staff, and he did not think there could be any higher tribute to the efficiency and organising capacity of their departed friends than the fact that the board were able to find amongst their subordinates men well trained to fill every position in a most satisfactory manner. The directors had power to appoint a general manager, and to that position, which was a new one, they appointed Mr. G. M. Harriss, who had been the electrical engineer since 1911. Mr. Harriss was engineer to the International Exhibition of 1907, and as chairman of the Working Committee of the Exhibition he (Mr. Murphy) had opportunities of appreciating his resourcefulness and versatility. He asked him to go to West Africa, where he was building a railway, but recalled him to take up the position of electrical engineer vacant by the death of Mr. Sheardown. Mr. Harriss was already justifying his judgment in his appointment as general manager. Mr. M'Hugh, the secretary, had been chief accountant, and Mr. Brophy, traffic manager, was chief clerk to Mr. Gordon. Both these gentlemen were giving the utmost satisfaction. It could not fail to have a good effect on the service generally when men found that their promotion was not indefinitely postponed by the importation of outsiders to the higher positions. He ventured to say that there was no tramways undertaking with a more competent staff than that by whom this company were served. Dealing with the balance sheet, the Chairman said there was an item of £332 for new wagons to work the growing goods traffic, which showed an increase of £323. This was earned at an additional cost of £83. The gross receipts, the largest yet recorded, were £333,899, against £321,896. Of this increase £11,677 was due to passenger traffic. The parcel traffic continued to grow, the increase being £337. The gross expenses exceeded those of 1914 by £18,143, which included war allowances amounting to £4,536. The increase in expenses was greater by £6,140. In "operation" there was an increase of £4,161. The average cost of 24,000 tons of coal consumed was 3s. a ton higher, being 18s. 5d. They had contracted for enough coal to carry them through this year, but at a higher price. The greatest increase came under that of "maintenance," and amounted to £10,154. Of this nearly £6,000 was incurred on road and track maintenance, and £2,700 represented car motors and electrical car equipment. He expressed regret that at this time of national crisis the Corporation were altering the levels of some roadways, thus necessitating the relaying of certain tramways at a cost of £1,727. These roadways could have answered their purpose for a few years longer, or at least until the present prices of all kinds of material had come down. Wages under the head of "traffic expenses" were up by £3,909, of which £2,632 was due to war bonus and separation allowances, and some more of it to the manning of cars for an addition of 200,000 car-miles run in excess of 1914. There was a decrease of £2,394 in the item of "law and compensation"; an increase of £1,371 in rates and taxes, and a net decrease of £890 in "general charges." The result of the working for the year 1915 was a profit of £124,516, which, with £11,366 from last account, and £1,902 interest on investments, gave £137,784 at credit of net revenue account to meet the standing charges, dividends, and appropriations. After paying the standing charges, a sum of £95,845 remained. Last year they appropriated £18,000 out of the balance on revenue account to the renewal of permanent way fund, which brought that fund up to £40,490. During the year they expended £16,214 on renewals of rails, reducing the reserve for this purpose to £24,276. They proposed now to appropriate £18,000 out of the profits to the same fund for renewals, which would bring it up again to £42,275, or £1,785 more. The new rails were 105 lb. to the yard, replacing 92 lb. rails, which should give the renewed lines a longer life. They started the new year with an increase of traffic of more than £2,000 for the month of January.

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BRISTOL TRAMWAYS COMPANY.

A Successful Year.—Increasing Motor Business.

The report of the Bristol Tramways and Carriage Company, Limited, for the year ended December 31, 1915, shows that the gross receipts for the year amounted to £512,385, and the working expenses and renewals to £413,521, leaving a net revenue of £98,864. After making provision for debenture interest, preference dividend, etc., as shown in the appended summary, the balance available for appropriation is £37,680, out of which a final dividend has been paid for the half year at the rate of 6 per cent. per annum (subject to income tax), making 5 per cent. for the year. An addition of £20,000 has been made to reserve for contingencies and renewals, and £5,055 has been carried forward to the next account. The receipts of the tramway department show an increase of 3·03 per cent., and those of the carriage department an increase of 23·39 per cent. The number of passengers carried during the year on the cars and motor omnibuses was 60,272,400, an increase of 1,970,815.

Results for the Past Three Years.

	1915	1914	1913
	£	£	£
Receipts—			
Tramways department ...	248,355	230,651	243,686
Carriage department ...	258,530	209,512	174,701
Sundry receipts	5,500	5,611	5,429
Total receipts	£512,385	£454,774	£423,816
Expenditure—			
Traffic expenses	175,415	174,623	164,810
General expenses	75,916	58,947	49,274
Renewals, repairs, and maintenance	162,189	138,615	129,498
Total expenses ...	£413,520	£372,185	£343,582
Net revenue	£98,865	£82,589	£80,234
Interest on debentures	30,502	30,638	27,443
Interest on investments (carried to reserve fund)	4,364	4,468	4,408
Dividend on 4 per cent. Pref. shares	17,333	18,458	18,833
Dividend on Ord. shares (5 per cent.)	21,610	20,724	21,188
Reserve fund for renewals ...	20,000	8,301	8,362
Carried forward	5,056	—	—
	£98,865	£82,589	£80,234

Since the beginning of the war, no fewer than 1,095 men in the company's employment have joined His Majesty's Forces, including 247 trained motor drivers, and a further number of 702 men have attested under Lord Derby's scheme, together about 90 per cent. of the total number of the eligible employees not actually engaged in munition work. To those employees on active service, who were with the company at the outbreak of war, and who had families or relatives dependent upon them, weekly allowances have been paid, and such allowances during the year amounted to the sum of £11,737. The depletion of the staff owing to recruiting has necessitated some restriction of the company's public services, but every effort has been made to reduce inconvenience to the public to the minimum. Notwithstanding the exceptional conditions which have prevailed during the year, the traffic receipts of both the tramways and carriage departments have increased. A much-needed motor omnibus service between Tewkesbury and Cheltenham has been inaugurated, but the opening of other contemplated new motor omnibus services in Bristol and other districts remains in abeyance during the war.

The motor constructional works and the tramway rolling stock works at Brislington have been largely employed throughout the year in the production of war munitions, including the making of aeroplane parts and fittings, and the construction and repair of motor workshops and motor lorries for the army.

During the year communications have passed between the Bristol Corporation and the company as to the former's option of purchasing the company's tramway undertaking, but without any result. As the Treasury has refused its consent to any public issue of stock by the Corporation for the purpose of tramway purchase, the directors offered, in order to remove the difficulty, to recommend the shareholders to approve the purchase price being satisfied by the issue of Corporation stock to return one-half per cent. more than the market yield of the Government stock at the date of the award, this being the relative difference in the respective stocks in normal times.

The extension of the company's memorandum of association, to include the execution of Government and other contracts, and the addition of new departments embracing the manufacture of aircraft, war material, and supply of electricity and other matters, which was approved by extraordinary general meetings of the company, received the sanction of the court on July 13 last. The Bill promoted by the company in the last session of Parliament to extend the powers not yet exercised for the acquisition of land and construction of tramways received the Royal Assent on June 24 last.

The directors record with extreme regret the death in April last of Mr. Hugh Greenfield Doggett, who had been associated with the company from its earliest years, and had been a director for the past five years. Mr. George Stanley White has been elected to fill the vacancy thus created.

ADELAIDE MUNICIPAL TRAMWAYS.

In our issue of May 13, 1915, some description was given of the progress of the tramway undertaking of the Adelaide Municipal Trust, which since its inception has been directed by Mr. W. G. T. Goodman, M.Inst.C.E., M.I.E.E., as chief engineer and general manager. The chairman of the Trust is Mr. Alex. B. Moncrieff, C.M.G., M.Inst.C.E., and the secretary Mr. Chas. R. Moyes. In addition to the chairman, the Trust consists of seven members, and the work is carried out under the supervision of the following committees:—

Finance—Messrs. Thos. Gill (chairman), Frank B. Moulden, and Arthur C. Sanders.

Traffic and Works Messrs. H. J. Holden (chairman), R. Cruickshank, I. Isaacs, and H. Sherriff.

Comparative statistics were given in the previous notice for each half year from July 31, 1907, to July 31, 1914, and we now append similar statistics for the half years ended January 31 and July 31, 1915, within which periods the Port Adelaide horse tramway system has been included in the undertaking and operated during its conversion to electric traction.

The Government of South Australia has advanced to the Trust on account of debenture capital £1,516,225, for the electrical equipment of the undertaking, and repayments have been made from the sinking fund to the extent of £155,306, and on July 31, 1915, the reserves were as follow:—Reserve for renewals account, £87,364; for insurance accounts, £8,307; balance carried forward, £4,486.

The net revenue for the half year on working was £57,795, and the standing charges amounted to £62,390, leaving a deficit for the half year of £4,595. A considerable proportion of the deficit is due to the operation of the horse-car service of Port Adelaide during its conversion to electric traction, and to works of extraordinary revenue expenditure on permanent way (neither of which losses was due to the operation of the system), and to a contribution to war funds, i.e., wages paid to dependants of employees who have enlisted for active service, amounting to £906. The gross revenue was £153,283, or £11,420 less than for the corresponding half year ending July 31, 1914, and £18,000 less, it is estimated, than the revenue for the half year would have been had the economic conditions remained normal. The entire capital cost of the revenue earning portion of the electric traction system, excluding purchase money and stores, was £1,399,996. The surplus revenue over operating expenses (excluding the Port Adelaide horse car account) was £58,206, the percentage of working expenses to revenue being thus 61·926 per cent. In addition to meeting the whole of the obligations to date, the whole of the interest on purchase money (£83,096) has been paid.

During the half year ended July 31, 1915, the Morialta and the Goodwood extensions and the Millswood sub-way were completed, in addition to several contracts for the electrical equipment of the Port Adelaide tramways.

	Half-year ended Jan. 31, 1915	Half-year ended July 31, 1915
Revenue.		
Electric traction—		
Traffic receipts	£154,942	£150,213
Sundry receipts	£1,719	£2,586
Horse traction (Port Adelaide)—		
Traffic receipts	£110	£408
Interest	£378	£76
Total revenue	£157,149	£153,283
Expenditure and Appropriation.		
Total operating expenses	£96,581	£95,488
Reserve for renewals	£8,687	£8,678
Interest on purchase money	£4,387	£4,367
Interest on advance for construction ...	£26,381	£26,012
Sinking fund	£22,976	£23,333
Total expenditure and appropriation ...	£159,012	£157,879
Debit balance	£1,862	£4,595
Revenue per car mile	15·020d.	15·254d.
Expenses per car mile	9·220d.	·447d.
Ratio operating expenses to revenue ...	61·386%	61·926%

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Other.	Total.
Aberdeen ...	*May 31, 1915	Dec., 1899	E.	27	56	415,000	366,332	48,668	366,332	13,225	184,118	234,194	189,803	86,614	1,388	88,002
Accrington ...	Mar. 31, 1914	Aug., 1907	,,	10	53	181,925	133,875	48,050	134,734	12,636	113,870	20,864	16,581	29,843	350	30,193
Ashton-u-Lyne..	*Mar. 25, 1915	Aug., 1902	,,	8	15	130,070	111,376	18,694	111,376	13,599	66,708	36,236	3,200	22,577	343	22,920
Ayr	*May 15, 1915	Sept..1901	,,	9	30	128,000	98,630	29,369	100,705	10,742	78,770	27,866	17,649	17,181	804	17,985
Birmingham ..	*Mar. 31, 1915	Jan., 1904	,,	118	71	2,858,935	2,437,104	421,831	2,472,938	20,801	1,940,158	496,946	176,726	640,091	6,923	647,014
Blackburn .	*Mar. 25, 1915	Mar., 1899	,,	24	63	408,174	342,474	65,700	336,258	13,566	354,600	191,985	3,718	65,158	3,144	68,302
Blackpool ..	*Mar. 31, 1915	June, 1899	,,	(p)21	51	460,473	316,005	144,468	316,005	14,604	316,005	138,577	19,698	75,344	761	76,105
Bolton	*Mar. 31, 1915	Dec., 1899	,,	47	69	551,092	551,092	Nil	570,981	11,930	348,111	202,980	43,059	140,182	1,228	141,410
Bradford ...	*Mar. 31, 1915	July, 1898	,,	(h)118	9	1,280,788	1,043,788	237,000	1,043,054	8,831	634,618	439,321	75,208	309,320	20,568	329,888
Brighton	*Mar. 31, 1915	Nov., 1901	,,	17	15	378,093	279,978	98,115	280,392	16,314	211,268	69,124	7,562	54,413	2,113	56,526
Burnley	*Mar. 31, 1915	Dec., 1901	,,	22	18	388,052	326,077	61,975	232,580	10,465	170,852	72,664	29,550	77,161	1,306	78,467
Burton-on-Trent	*Mar. 31, 1915	Aug., 1903	,,	10	50	108,632	104,562	4,070	106,275	10,121	47,788	56,784	10,134	15,223	1,510	16,733
Bury	*Mar. 31, 1915	June, 1903	,,	(b)36	10	407,800	284,745	123,055	293,237	12,826	254,832	55,416	33,960	68,740	276	69,016
Chester	*Mar. 25, 1915	April, 1903	,,	6	35	92,991	82,380	10,611	82,934	12,883	66,977	16,059	5,072	12,935	317	13,252
Chesterfield ..	Mar. 31, 1914	Dec., 1904	,,	5	8	98,000	73,500	24,500	69,810	13,663	57,660	13,820	6,307	13,608	465	14,073
Colchester ..	*Mar. 31, 1915	July, 1904	,,	7	75	70,748	69,555	1,193	69,471	8,736	48,360	22,007	Nil.	13,413	380	13,793
Croydon	*Mar. 31, 1915	(q) Sept., 1901	,,	17	50	287,689	287,689	Nil	286,765	16,271	222,223	107,039	41,643	87,833	781	88,614
Darlington ..	*Mar. 31, 1915	June, 1904	,,	8	71	107,500	77,889	29,611	8,748	77,870	55,236	25,881	7,369	13,451	261	13,712
Darwen	*Mar. 31, 1915	Oct., 1900	,,	7	13	93,400	86,300	7,100	87,199	12,174	51,200	33,555	9,396	14,645	988	15,633
Derby	*Mar. 31, 1915	July, 1904	,,	22	27	...	...	...	248,373	11,113	...	74,267	(r)38,410	51,903	978	52,881
Doncaster ..	Mar. 31, 1914	June, 1902	,,	12	58	...	...	..	107,921	8,481	94,700	16,581	1,442	22,890	318	23,208
Dundee	*May 15, 1915	July, 1900	,,	28	32	(f)	362,789	...	371,145	13,068	266,027	96,762	92,694	66,320	1,954	68,274
East Ham ..	*Mar. 31, 1915	June, 1901	,,	14	16	192,270	191,016	254	196,309	13,824	129,336	78,806	...	59,552	680	60,232
Exeter ...	*Mar. 31, 1915	April, 1905	,,	7	0	106,000	88,818	17,182	88,818	12,688	67,966	21,360	6,420	17,964	55	18,019
Gloucester ..	*Mar 31, 1915	April, 1904	,,	15	1	191,000	144,333	46,667	147,783	9,846	104,965	22,901	1,000	16,693	1,114	17,807
Halifax	*Mar. 31, 1915	June, 1898	,,	55	39	449,263	417,466	31,797	420,185	7,570	283,249	129,670	36,442	111,792	1,378	113,170
Ilford	*Mar. 31, 1915	Mar., 1903	,,	12	49	152,883	152,883	Nil	149,574	11,859	102,839	50,043	3,239	31,539	442	31,981
Ilkeston	Mar. 31, 1914	May, 1903	,,	3	56	64,214	47,000	17,214	47,833	13,436	31,462	16,422	...	6,915	171	7,086
Ipswich	*Mar. 31, 1915	Nov., 1903	,,	14	70	116,471	114,300	2,171	115,676	7,776	94,894	115,549	15,940	22,796	493	23,289
Keighley	*Mar. 31, 1915	Oct., 1904	,,	6	9	50,934	47,711	3,223	...	...	26,936	20,774	...	8,957	296	9,253
Kilmarnock ..	*May 15, 1915	Dec., 1904	,,	5	47	65,000	52,795	12,205	52,801	9,450	46,450	10,078	6,618	8,416	201	8,617
Kirkcaldy ..	*May 15, 1915	Feb., 1903	,,	8	65	213,000	97,868	115,132	97,868	11,105	76,466	21,402	5,223	16,564	412	16,976
Lancaster ..	*Mar. 31, 1915	Jan., 1903	,,	4	65	...	45,700	...	43,711	9,083	28,750	17,669	3,342	5,534	159	5,693
Leith	*May 15, 1915	Aug., 1905	,,	17	73	275,000	238,000	37,000	237,983	13,286	171,500	66,070	6,604	36,298	1,086	37,384
Leyton	Mar. 31, 1914	Dec., 1906	,,	18	8	324,201	324,145	56	295,376	16,319	240,741	57,244	2,654	69,148	1,541	70,689
Lincoln	*Mar. 31, 1915	Nov., 1905	S.	2	77	98,519	44,947	53,572	44,987	15,185	40,226	12,529	(t) 692	6,435	117	6,552
Liverpool ...	Dec. 31, 1914	Nov., 1898	E.	124	0	2,622,786	2,057,850	564,936	2,062,391	16,741	1,168,685	1,177,949	366,545	684,026	13,050	697,076
Lowestoft ...	Sep. 30, 1914	July, 1903	,,	4	6	96,230	91,178	5,052	91,178	22,375	75,480	17,614	Nil	11,357	373	11,730
Maidstone ...	*Mar. 31, 1915	July, 1904	,,	7	3	82,932	82,932	Nil	79,398	11,282	63,598	19,334	...	10,402	602	11,004
Manchester ...	*Mar. 31, 1915	June, 1901	,,	203	31	2,361,038	2,207,215	153,823	2,216,009	10,895	1,648,183	548,499	438,497	887,763	14,112	901,875
Nelson	*Mar. 31, 1915	Feb., 1903	,,	3	69	38,000	37,885	115	37,885	9,808	28,086	9,799	...	9,300	52	9,352
Newport (Mon.) ..	*Mar. 31, 1915	April, 1903	,,	14	28	232,500	196,250	36,250	196,184	13,671	155,216	49,868	3,479	41,752	952	42,704
Nottingham ...	*Mar. 31, 1915	Jan., 1901	,,	44	20	...	...	...	733,674	16,586	473,999	261,364	56,626	176,289	3,026	179,315
Oldham	*Mar. 25, 1915	May, 1902	,,	28	32	506,723	446,347	60,376	453,655	15,981	303,738	166,268	2,222	111,679	2,135	113,814
				(b) 8	31											
Perth	May 15, 1914	Nov., 1913	,,	6	75	90,000	78,350	11,650	78,629	11,334	...	...	...	8,944	928	9,872
Plymouth ...	Mar. 31, 1914	Sept., 1899	,,	15	0	182,856	181,479	1,377	219,417	14,628	86,903	89,493	24,252	39,989	891	40,880
Pontypridd ...	*Mar. 31, 1915	Mar., 1905	,,	8	50	137,847	137,839	8	138,568	17,321	107,403	30,436	Nil	22,819	427	23,246
Rawtenstall ...	*Mar. 31, 1915	May, 1909	,,	15	71	193,290	182,172	11,118	182,276	11,709	150,324	31,848	3,051	24,460	1,076	25,536
Rochdale	*Mar. 31, 1915	May, 1902	,,	(i) 40	2	356,991	347,782	9,209	353,200	15,407	347,782	108,034	16,000	77,660	5,742	83,402
Rotherham ...	*Mar. 31, 1915	Jan., 1903	,,	12	2	342,200	188,326	153,874	184,178	15,316	150,485	39,473	21,771	43,834	59	43,893
			R.T	...		...	...	...	...	...	...	...	...	...	...	...
Salford	*Mar. 31, 1915	Oct., 1901	E.	75	64	1,086,472	723,717	362,755	725,485	9,571	511,853	282,115	30,058	257,935	42	257,977
Southampton ...	*Mar. 31, 1915	Jan., 1900	,,	18	54	280,452	260,699	19,753	259,834	13,913	158,729	99,470	14,251	68,042	2,996	71,038
Southend-on-Sea	Mar. 31, 1913	July, 1901	,,	11	49	130,000	129,961	39	143,808	12,384	116,940	12,784	3,045	34,453	465	34,918
Southport ...	*Mar. 31, 1915	July, 1900	,,	(d) 10	63	292,000	197,730	94,270	196,178	8,424	67,250	57,870	442	19,970	450	20,420
South Shields ...	*Mar. 31, 1915	Mar., 1906	,,	10	21	251,882	184,056	67,826	181,097	17,646	155,214	37,314	30,837	39,275	570	39,845
Staly'ge, H., M., D.	*Mar. 31, 1915	May, 1904	,,	27	57	325,270	280,990	44,280	279,778	10,096	209,387	71,603	1,211	37,490	130	37,620
Stockport ...	*Mar. 31, 1915	Aug., 1901	,,	27	5	318,847	234,500	84,347	265,014	9,789	155,686	92,313	37,776	(a)65,533	1,203	66,736
Sunderland ...	*Mar. 31, 1915	Aug., 1900	,,	20	28	308,699	303,211	5,488	306,766	15,074	161,996	132,265	45,044	75,229	386	75,615
Swindon ...	Mar. 31, 1914	Sept., 1904	,,	4	42	...	...	...	44,216	9,771	33,861	11,738	7,237	8,602	309	8,911
Wallasey ...	*Mar. 31, 1915	Mar., 1902	,,	19	77	208,867	195,290	13,577	222,027	11,122	159,306	72,879	10,612	63,690	815	64,505
Walsall	Dec. 31, 1914	Dec., 1902	,,	19	44	188,145	188,100	45	182,926	9,357	154,044	63,649	34,960	33,311	778	34,089
Walthamstow ...	*Mar 31, 1915	June, 1905	,,	13	30	198,000	194,000	4,000	190,477	14,251	168,248	25,249	...	41,346	443	41,789
Warrington ...	*Mar. 31, 1915	April, 1902	,,	9	52	103,674	102,896	778	102,128	10,583	67,028	35,869	7,977	22,631	261	22,892
West Ham ...	*Mar. 31, 1915	Feb., 1904	,,	30	4	578,478	551,588	26,890	556,878	18,532	469,051	123,888	26,236	147,703	4,509	152,212
West Hartlepool	*Mar. 31, 1915	Feb., 1904	,,	8	63	85,494	80,330	5,164	81,731	9,301	76,501	3,682	4,614	19,011	494	19,505
Wigan	*Mar. 31, 1915	April, 1901	,,	30	73	502,513	491,007	11,506	481,577	15,579	382,490	157,287	5,034	75,270	2,107	77,377
Wolverhampton ..	*Mar. 31, 1915	April, 1902	S.	21	40	279,733	268,185	11,548	292,361	13,596	209,497	71,812	53,987	54,593	730	55,323
Yarmouth (Gt.)..	*Mar. 31, 1915	June, 1902	E.	14	58	149,600	124,750	24,850	126,453	8,588	115,700	29,148	9,613	21,872	494	22,366
York	*Mar. 31, 1915	Jan., 1910	,,	12	20	157,150	...	...	163,884	...	151,039	8,596	6,456	29,589	538	30,127

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	*Mar. 31, 1915	Nov., 1905	E.	98	54	1,528,146	1,381,200	136,946	1,455,506	14,702	1,343,000	257,730	96,622	266,249	3,988	270,237
Bexley	Mar. 31, 1914	Oct., 1903	,,	6	42	100,798	98,812	1,986	98,408	15,376	75,408	23,403	942	14,698	1,649	16,346
Birkenhead ...	*Mar. 31, 1915	Feb., 1901	,,	24	7	378,973	373,290	5,683	373,545	15,548	228,391	143,241	23,062	65,100	685	65,785
Bournemouth ...	*Mar. 31, 1915	July, 1902	,,	(e)32	67	...	...	...	467,073	18,379	291,667	168,818	17,765	101,882	464	102,346
Cardiff	*Mar. 31, 1915	May, 1902	,,	31	66	832,356	787,292	45,064	811,043	25,484	485,049	302,242	98,778	139,256	36,785	176,041
Coventry ...	*Mar. 31, 1915	Jan., 1912	,,	15	61	251,014	238,355	12,659	238,803	15,151	229,235	14,363	4,095	44,633	771	45,404
Glasgow	*May 31, 1915	Oct., 1898	,,	198	10	4,564,266	3,694,143	870,123	3,751,708	19,127	2,411,868	1,282,275	2,326,543	1,070,694	6,184	1,076,878
				(b) 2	53											
Huddersfield ...	*Mar. 31, 1915	Feb., 1901	,,	56	4	772,662	467,142	305,520	477,919	8,526	281,927	194,599	7,522	124,200	2,859	127,059
Hull	*Mar. 31, 1915	July, 1899	,,	33	12	662,074	594,626	67,448	596,092	17,982	579,628	183,392	147,663	161,750	1,280	163,030
Leeds	*Mar. 31, 1915	Aug., 1897	,,	115	71	1,907,865	1,814,758	93,107	1,678,844	14,487	1,400,687	590,421	4,961	429,902	4,038	433,940
Leicester... ...	Dec. 31, 1914	May, 1904	,,	37	0	1,006,946	818,073	138,290	828,953	22,404	674,936	147,944	91,843	149,664	20,571	170,238
London	*Mar. 31, 1915	...	H.	9	67				...	...	...	...	...	10,261	540	10,801
		May, 1903	C.E	274	35	(c)	(c)	(c)	13,744,806	...	9,836,187	3,786,403	565,095	2,323,130	65,916	2,389,046
N'castle-on-Tyne	*Mar. 31, 1915	Dec., 1901	E.	62	72	1,597,129	1,309,200	287,929	1,332,133	21,178	905,066	524,407	74,656	280,147	13,117	293,264
Northampton ...	*Mar. 31, 1915	July, 1904	,,	12	37	239,800	147,255	92,545	173,019	13,883	118,932	48,610	14,628	30,775	534	31,309
Portsmouth ...	*Mar. 31, 1915	Sep., 1901	,,	34	48	708,619	708,619	Nil	731,174	21,132	423,103	285,516	81,715	121,909	2,082	123,991
Preston	Mar. 31, 1914	June, 1904	,,	17	16	224,102	187,269	36,833	187,269	10,888	117,315	47,130	39,392	45,618	328	45,946
Reading	*Mar. 31, 1915	July, 1903	,,	13	14	235,000	234,000	1,000	237,102	17,996	155,419	75,406	19,471	35,608	1,074	36,682
Sheffield	*Mar. 25, 1915	Sep., 1899	,,	79	8	1,782,471	1,484,400	298,071	1,558,246	19,703	1,122,482	512,567	34,450	391,535	2,996	394,531
Wellington, N.Z.	Mar. 31, 1914	...	,,	31	55	496,423	496,423	...	628,151	19,821	496,423	46,836	120,191	157,096	1,161	158,257

C—Electric conduit system. E—Electric trolley system. H—Horse lines RT—Railless trolley system. S—Surface contact system.
(a) Includes £1,441 trackless. (b) Includes leased lines. (c) Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed
(d) Not including 12 miles 40 chains leased lines. (e) Includes 7 miles 34 chains leased lines. (f) Unlimited. (h) Includes 9 miles 26 chains railless trolley routes.
(i) 17 mi. 8 chn. single track leased. (l) Including Insurance. (p) Including leased lines. (q) Corporation working commenced June, 1906. (r) Including £5,744 Accident Reserve.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Working Expenses.					Gross Profit on Working.	Additions to Gross Profit.	Deductions from Gross Profit.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal.	Sundries.	Total.	
Aberdeen	23,291	12,148	7,920	8,166	51,525	36,477	...	4,789	5,179	...	13,840	(i) 1,669	25,477	+ 11,000
Accrington	7,570	2,792	2,268	4,880	17,510	12,683	...	3,969	3,783	198	3,100	65	11,115	+ 1,568
Ashton-und'r-Lyne	5,215	(i) 1,919	2,874	3,470	13,478	9,442	...	2,300	3,965	776	250	...	7,291	+ 2,151
Ayr	4,682	(i) 2,301	1,494	2,504	10,981	7,004	...	2,487	2,310	...	...	...	7,004	...
Birmingham	187,946	(i) 86,491	86,067	113,375	473,879	173,135	5,558	71,965	58,402	...	...	730	131,097	+ 47,596
Blackburn	16,859	6,197	14,451	9,421	46,928	21,374	287	(h) 4,388	15,450	251	1,572	...	21,661	...
Blackpool	17,632	(i 7,755	9,239	10,225	44,851	31,254	...	(h) 9,878	7,640	...	...	...	17,518	+ 13,736
Bolton	30,044	(q) 9,486	15,912	20,689	76,131	65,279	857	(h) 10,525	17,520	1,713	18,339	(i) 981	49,078	+ 17,058
Bradford	91,597	(i) 36,890	64,670	52,938	246,095	83,793	4,525	22,087	24,164	5,422	7,832	4,203	63,708	+ 24,610
Brighton	14,152	(i) 6,759	13,690	8,384	42,985	13,541	55	7,661	5,917	...	...	...	13,578	+ 18
Burnley	21,142	(i) 10,079	9,141	17,955	58,317	20,150	...	6,796	8,284	1,515	...	(f) 1,890	18,486	+ 1,664
Burton-on-Trent	5,609	(i) 1,821	2,686	3,086	13,202	3,531	24	1,266	1,451	...	...	...	2,717	+ 838
Bury	16,129	4,971	7,162	7,504	35,766	33,250	303	(h) 7,037	6,026	825	2,472	(w) 11,193	27,553	+ 6,000
Chester	3,304	(i) 1,834	1,318	2,256	8,712	4,540	130	(h) 2,748	1,018	...	904	...	4,670	...
Chesterfield	3,214	1,368	2,936	2,192	9,710	4,363	269	2,275	1,900	...	...	...	4,175	+ 457
Colchester	3,045	1,372	2,370	2,783	9,570	4,223	28	(h) 1,986	2,496	...	...	(i) 172	4,654	− 503
Croydon	31,319	(i) 9,151	14,128	17,684	72,282	16,332	749	7,889	7,415	1,587	...	...	16,891	+ 190
Darlington	4,273	896	1,895	2,103	9,167	4,545	160	1,926	2,006	101	1,202	...	5,235	− 530
Darwen	4,064	1,146	3,260	2,653	11,123	4,510	222	2,221	2,190	...	1,050	...	5,461	− 729
Derby	18,514	(i) 3,502	6,926	8,941	37,883	14,998	199	6,152	3,568	§ 12	5,432	(l) 141	15,305	− 108
Doncaster	4,969	1,342	6,550	4,166	17,027	6,181	16	2,935	1,840	138	572	58	5,543	+ 654
Dundee	17,829	(i) 7,398	7,445	10,686	43,358	24,916	...	8,990	6,700	323	7,842	...	23,855	+ 1,061
East Ham	19,381	6,796	14,558	10,884	51,619	8,613	...	5,279	6,858	...	...	...	12,137	− 3,524
Exeter	4,793	1,535	1,715	3,556	11,599	6,420	...	(h 2,241	1,950	120	...	...	4,311	+ 2,109
Gloucester	7,250	1,643	2,975	1,836	13,704	4,103	...	(h) 5,362	1,881	370	...	...	7,613	− 3,510
Halifax	30,501	7,877	13,529	21,597	73,504	39,321	345	10,424	12,106	...	(y) 925	(i) 2,632	23,455	+ 16,211
Ilford	10,444	3,518	4,171	5,387	23,520	8,461	557	3,786	5,252	...	...	...	9,038	− 20
Ilkeston	2,262	789	1,378	1,460	5,889	1,197	160	1,450	1,532	90	...	96	3,168	− 1,811
Ipswich	8,801	1,962	5,033	3,494	19,290	3,999	(u) 4,877	(h) 3,660	2,207	...	3,421	(i) 237	9,525	− 640
Keighley	3,129	729	1,210	1,676	6,744	2,509	190	935	1,876	...	...	...	2,811	− 112
Kilmarnock	2,995	(i) 801	1,434	1,636	6,866	1,751	5	(h) 1,863	1,110	...	1,160	...	4,133	− 2,377
Kirkcaldy	4,811	1,416	2,312	2,912	11,451	5,525	68	2,604	2,411	...	409	136	5,560	+ 33
Lancaster	2,207	(i) 617	879	1,615	5,318	375	52	942	1,250	...	...	...	2,192	− 1,765
Leith	9,979	3,455	5,148	4,215	22,797	14,587	2,264	(h) 6,029	7,850	...	3,252	150	17,281	− 420
Leyton	(p) 22,360	8,611	13,711	12,923	57,605	13,084	133	10,007	8,461	...	...	202	18,670	− 5,453
Lincoln	1,446	656	967	872	3,941	2,611	47	1,529	1,071	...	...	(i) 6	2,606	+ 52
Liverpool	192,352	69,830	83,100	123,527	468,809	228,267	25,231	50,082	63,726	...	(d) 34,821	(e) 4,869	153,498	+ 100,000
Lowestoft	3,405	655	1,552	2,323	7,935	3,795	..	2,441	2,251	...	...	...	4,692	− 897
Maidstone	2,584	1,152	2,052	1,771	7,559	3,445	56	2,473	1,976	...	...	...	4,449	− 958
Manchester	273,002	(i) 117,573	85,280	128,350	604,205	297,670	14,615	(h) 58,243	57,599	13,790	48,584	(c) 34,069	212,285	+ 106,000
Nelson	2,390	798	1,717	1,982	6,887	2,465	...	958	1,059	...	...	314	2,331	+ 134
Newport (Mon.)	10,429	4,234	9,655	6,638	30,956	11,748	857	5,694	4,357	...	1,886	(i) 668	12,605	...
Nottingham	48,272	14,674	17,408	30,692	111,046	68,269	...	16,444	21,121	...	...	(i) 2,040	39,605	+ 28,664
Oldham	27,159	10,158	28,025	19,742	85,084	28,730	1,639	16,158	11,734	2,347	...	(g) 5,799	36,038	− 5,669
Perth	...	...	...	...	6,002	3,870	...	...	...	...	...	...	...	...
Plymouth	8,430	3,896	4,514	8,026	24,866	16,014	1,257	4,282	3,141	690	5,121	...	13,234	+ 4,037
Pontypridd	5,194	1,363	6,831	3,291	16,670	6,575	...	3,761	3,791	...	‖ 665	252	8,469	− 1,899
Rawtenstall	6,126	2,446	3,187	4,273	16,032	9,504	85	5,483	6,493	...	...	...	11,976	− 2,387
Rochdale	19,308	5,063	10,984	11,537	46,892	36,510	1,636	11,478	9,594	2,038	...	(i) (s) 10,752	33,862	+ 4,284
Rotherham	E 11,039 RT ...	4,071 ...	5,864 ...	8,718 ...	29,692 ...	14,201 ...	195 ...	5,349 ...	3,465 ...	... ...	4,082 ...	... ...	12,896 ...	+ 1,800 ...
Salford	75,579	(i) 24,562	27,778	48,819	176,748	81,229	4,477	15,791	668	4,112	492	(k) 29,378	51,441	+ 34,265
Southampton	21,466	(i) 6,862	9,433	12,545	50,306	20,732	(t) 6,757	7,564	7,557	952	5,000	...	21,073	+ 6,416
Southend-on-Sea	8,046	2,260	3,534	6,187	20,027	14,891	4,228	(h) 3,834	1,753	...	4,017	...	9,605	+ 9,614
Southport	4,922	(i) 2,406	2,765	3,015	13,108	7,312	6,249	6,549	5,018	...	2,120	...	13,687	− 126
South Shields	9,249	(i) 5,225	4,156	6,880	25,510	14,335	140	5,230	3,651	...	...	...	8,881	+ 5,594
Staly'dge, H., M., D.	12,818	(i) 5,022	7,448	5,761	32,049	5,571	...	7,485	7,786	...	400	397	16,068	− 10,497
Stockport	15,630	5,817	10,718	4,683	36,848	29,886	2,260	5,240	10,008	1,586	3,134	2,790	22,758	+ 9,537
Sunderland	19,807	5,608	4,867	11,267	41,549	34,066	265	(h) 6,464	10,374	1,218	10,875	400	29,331	+ 5,000
Swindon	2,854	828	1,534	1,850	7,066	1,845	45	1,215	1,422	...	...	...	2,637	− 747
Wallasey	18,736	(i) 6,704	6,213	10,801	42,454	22,051	1,249	5,520	5,072	...	...	634	11,226	+ 12,074
Walsall	8,510	3,326	4,315	5,670	21,821	12,268	1,339	4,962	3,975	551	640	...	10,128	+ 3,479
Walthamstow	14,417	2,972	8,845	8,546	34,780	7,009	30	(h) 6,427	3,468	...	...	(i) 712	10,607	− 3,563
Warrington	6,135	(i) 2,556	2,996	3,323	15,010	7,882	481	2,418	3,447	...	...	...	5,865	+ 2,498
West Ham	52,659	† 14,531	33,326	19,420	119,936	32,276	243	18,875	12,679	...	692	...	32,246	+ 273
West Hartlepool	4,791	1,586	2,956	2,241	11,574	7,931	3	2,569	1,847	...	..	(f) 500	4,916	+ 3,018
Wigan	17,340	5,252	12,768	10,817	46,177	31,200	331	(h) 13,866	13,101	...	...	3,662	30,629	+ 902
Wolverhampton	13,031	(i) 6,239	8,594	7,202	35,066	20,257	(x) 2,535	7,760	5,669	203	5,416	...	19,048	+ 3,744
Yarmouth (Gt.)	7,397	(i) 1,989	2,833	4,441	16,660	5,706	40	(h) 4,158	2,883	...	...	...	7,041	− 1,295
York	9,958	(i) 2,908	2,785	6,004	21,655	8,472	...	(h) 5,176	2,084	...	...	...	7,260	+ 1,212

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	75,752	17,245	35,294	28,622	156,913	113,325	...	48,342	31,277	1,478	17,879	2,164	101,140	+ 12,185
Bexley	3,282	1,382	*3,554	828	(s) 11,630	4,716	...	2,794	2,509	...	324	...	5,627	− 911
Birkenhead	15,923	(i) 5,621	12,124	5,839	39,507	26,278	...	(h) 11,340	9,760	527	3,500	151	25,278	+ 1,000
Bournemouth	22,933	7,998	9,095	15,040	55,066	47,280	955	(h) 10,587	16,535	...	...	(i) 12,166	39,288	+ 8,947
Cardiff	43,914	11,332	26,879	26,593	108,718	67,323	1,123	23,925	22,645	2,272	6,947	2,655	58,444	+ 10,002
Coventry	13,626	4,333	9,005	3,564	30,528	14,876	137	8,521	5,755	...	...	(i) 634	14,910	+ 103
Glasgow	345,625	(i) 193,837	144,530	51,995	735,987	340,891	65,826	78,797	105,492	22,790	172,310	14,377	393,766	+ 12,951
Huddersfield	33,571	(i) 7,911	20,449	12,047	73,978	53,081	...	(h) 12,536	13,061	2,274	15,575	1,235	44,681	+ 8,400
Hull	(i) 58,137	12,634	31,909	11,622	114,302	48,728	...	16,578	13,883	576	3,117	...	34,154	+ 14,574
Leeds	115,601	40,347	43,609	28,577	228,134	205,805	7,837	47,174	57,773	7,356	11,928	(i) 7,844	132,075	+ 81,867
Leicester	59,052	11,397	22,836	25,322	118,607	51,628	1,660	24,218	13,764	2,801	10,741	1,284	52,808	+ 480
London	H. 4,737 E. 793,481	1,859 (r) 276,574	3,878 364,064	(m) 5,854 250,124	16,328 1,684,243	def. 5,527 704,803	... 47,425	350,301	405,605	32,102	1,541	(l) 15,851	785,400	− 33,172
N'castle-on-Tyne	79,328	25,580	31,120	24,430	160,458	132,806	3,197	(h) 29,574	43,356	5,411	68	(i) 13,837	92,246	+ 43,757
Northampton	8,428	3,187	3,103	6,136	20,854	10,455	473	(h) 3,900	4,624	441	90	(ab) 1,221	10,276	+ 652
Portsmouth	31,414	(i) 13,293	8,371	5,580	58,658	65,333	(a) 11,483	21,643	18,455	1,941	11,677	532	54,248	+ 22,568
Preston	12,350	4,989	9,252	2,995	29,586	16,360	...	3,625	5,038	...	...	1,356	10,019	+ 6,341
Reading	8,324	(i) 4,356	4,313	3,643	20,634	16,028	11	6,709	5,062	263	...	...	12,034	+ 4,005
Sheffield	120,296	(i) 31,784	45,385	49,365	246,830	147,701	2,056	31,747	42,504	5,567	30,017	8,014	117,849	+ 31,908
Wellington, N.Z.	57,973	7,775	21,918	17,947	105,613	52,644	2,091	19,865	4,757	...	14,682	...	39,304	+ 18,431

(a) Includes £10,703 balance forward from previous year. (b) Includes £152 loss on omnibus account less profit on parcel service. (c) Includes £1,611 insurance fund. (d) Includes reserve. (e) Includes rents for leased lines. (f) Rent of leased lines. (g) Rent of lines and deficit on motor omnibus account. (h) Including income tax. (i) Includes Army Service Allowance. (j) Includes £692 deficit on railless traction. (k) Includes rents of lines. (l) Including loss on horse traction. (m) Horsing expenses. (n) Transferred to motor omnibus capital account. (o) Includes £1,337 through-running contributions. (p) Includes £407 horse account. (q) Includes National Insurance. (r) Including special charges. (s) Includes £2,584 through-running contributions to L.C.C. (t) Includes balance forward from previous year. (u) From borough fund. (w) Amount apportioned to leased lines. (x) Includes £1,554 profit on motor char-a-banc. (y) Parliamentary Expenses. (z) Includes £6,519 rent of leased lines. * Includes £1,913 spent on renewals. † Under a resolution of the Council, the allowances to employees serving with the Forces, amounting to £6,031, are defrayed out of rates and therefore not included in these accounts. ‡ £2,950 profit from 3 months' working. § Composition for Stamp Duty. ‖ Mortgage Loans.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus.			Receipts per Car Mile.		Operating Expenses per Car Mile.					Per-centage of Operating Expenses to Total Revenue.	Average Operating Expenses per Car Mile (excludi'g Power Cost).	Board of Trade Units.		
	Carried Forward.	Reserve.	Contribution to Rates or Municip'l Funds.	Average Total per Car Mile. d.	Average Traffic per Car Mile. d.	Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. (Price paid) d.	Total. d.	%	d.	Units.	Cost per Unit. d.	Units used per car mile.
Aberdeen ...	...	7,590	3,410	11·06	10·89	2·93	1·53	·99	1·03	6·48	58·54	5·45	2,317,204	·845	1·027
Accrington ...	...	...	1,568	12·64	12·49	3·17	1·18	·94	2·04	7·33	57·99	5·29	949,054	1·23	1·65
Ashton-u-Lyne	41	...	2,110	11·529	11·356	2·623	(c) ·965	1·446	1·745	6·779	58·80	5·034	659,302	1·125	1·382
Ayr... ...	..	...	...	9·61	9·18	2·50	1·25	·79	1·33	5·87	63	4·47	442,969	1·28	·98
Birmingham ...	30,000	17,596	...	10·910	10·793	3·169	1·459	1·451	1·912	7·991	73	6.079	24,185,574	1·125	1·7
Blackburn ...	...	...	...	13·81	13·71	3·40	1·25	2·92	1·91	9·48	68·70	7·57	1,739,274	1·3	1·84
Blackpool ...	...	1,736	12,000	16·82	16·65	3·90	1·71	2·04	2·26	9·91	58·93	7·65	1,552,635	1·58	1·43
Bolton	58	...	17,000	11·758	11·656	2·498	·788	1·323	1·721	6·330	53·836	4·610	4,514,010	1·1	1·56
Bradford... ...	...	14,610	10,000	12·425	11·816	3·457	1·041	2·450	2·027	8·975	74·60	6·948	12,272,121	1	1·926
Brighton... ...	18	...	...	12·240	11·782	3·064	1·464	2·964	1·816	9·308	72·79	7·10	1,676,770	1·2	1·51
Burnley	...	...	1,664	11·450	11·259	3·085	1·108	1·334	2·620	8·147	71·16	5·53	3,621,567	1·15	2·20
Burton-on-Trent	838	...	...	9·13	8·30	3·06	·99	1·47	1·68	7·20	78·5	5·28	530,080	1·39	1·04
Bury	...	(k)1,000	5,000	10·26	10·22	2·399	·776	1·253	1·268	5·696	51·82	4·428	2,045,692	1·25	1·26
Chester	...	...	...	9·16	8·94	2·28	1·27	·92	1·56	6·03	66	4·39	414,118	1·33	1·19
Chesterfield ...	...	457	...	11·1	10·8	2·54	1·08	2·31	1·73	7·66	68·9	5·93	420,824	1·25	1·38
Colchester ...	...	...	...	9·942	9·668	2·194	·989	1·709	2·006	6·898	69·24	4·892	445,214	1·5	1·34
Croydon	...	190	...	7·593	7·526	2·683	·784	1·211	1·516	6·194	78·68	4·493	3,000,308	1·416	1·071
Darlington ...	...	...	...	8·487	8·326	2·645	·554	1·172	1·304	5·675	66·85	4·371	504,546	1	1·301
Darwen	...	...	...	14·02	13·13	3·65	1·03	2·93	2·38	9·99	71·15	7·61	485,033	1·312	1·812
Derby	...	...	...	10·233	10·426	3·650	·691	1·365	1·763	7·469	71·6	5·706	1,479,947	1·45	1·216
Doncaster ...	...	654	...	10·52	10·37	2·24	·61	2·97	1·90	7·72	73·1	5·82	799,965	1·25	1·31
Dundee	...	61	1,000	11·802	11·465	3·082	1·278	1·288	1·847	7·495	63·5	5·648	2,564,659	1	1·847
East Ham ...	..	...	...	9·05	8·95	2·91	1·02	2·19	1·63	7·75	85·70	6·12	2,461,677	1·062	1·54
Exeter	...	2,109	...	9·629	9·60	2·560	·821	·917	1·900	6·198	64·37	4·298	615,956	1·375	1·38
Gloucester ...	...	...	...	6·84	6·41	2·78	·63	1·14	·71	5·26	77	4·55	470,336	1	·70
Halifax	...	(r) 7,483	(s)6,171	11·657	11·514	3·141	·812	1·393	2·225	7·571	65	5·35	4,607,293	1·125	1·98
Ilford	...	...	...	8·127	8·006	2·846	·729	1·164	1·109	5·848	73·6	4·60	1,131,616	1·125	1·172
Ilkeston	...	...	...	7·04	6·87	2·3	·8	1·3	1·4	5·8	83	4·4	372,200	1	1·84
Ipswich	...	...	...	8·705	8·52	3·290	·732	1·882	1·306	7·210	82·83	5·904	670,809	1·25	1·045
Keighley	...	...	...	8·962	8·675	3·031	·706	1·172	1·623	6·532	72·88	4·909	277,320	1·45	1·12
Kilmarnock ...	...	...	...	7·413	7·240	2·569	·695	1·235	1·408	5·907	79·6	4·499	314,191	1·25	1·13
Kirkcaldy ...	33	...	...	9·085	8·864	2·574	·758	1·238	1·558	6·128	67·4	4·57	698,804	1	1·558
Lancaster ...	...	...	...	8·10	7·80	3·11	·87	1·242	2·28	7·50	92·57	5·22	227,984	1·7	1·34
Leith	...	...	...	9·26	8·99	2·47	·86	1·27	1·03	5·63	60·98	4·60	984,428	1·027	1·02
Leyton	...	...	...	9·355	9·151	(c) 2·959	1·140	1·815	1·710	7·624	81·338	5·914	3,043,900	1·019	1·678
Lincoln	52	...	...	10·59	10·40	2·34	1·06	1·56	1·41	6·37	60·2	4·96	173,895	1·25	1·128
Liverpool ...	...	...	100,000	12·25	12·02	3·380	1·227	1·460	2·171	8·238	65·6	6·067	26,007,694	1·14	1·9
Lowestoft ...	...	...	...	9·1	8·8	2·60	·5	1·2	1·8	6·1	67·64	4·3	318,601	1·75	1·03
Maidstone ...	...	...	...	8·77	8·295	2·04	·90	1·63	1·40	5·97	71·96	4·57	366,191	1·125	1·217
Manchester ...	...	...	100,000	11·300	11·123	3·420	1·473	1·069	1·608	7·570	63·47	5·962	29,922,197	1·029	1·562
Nelson	134	...	...	11·66	11·60	2·98	·99	2·14	2·48	8·59	74	6·11	241,886	2	1·26
Newport (Mon.)...	...	...	...	10·622	10·385	2·594	1·053	2·402	1·651	7·700	72·49	6·049	1,178,500	1·30	1·22
Nottingham ...	...	6,164	22,500	11·35	11·16	3·06	·93	1·10	1·94	7·03	62·78	5·09	5,806,688	1·25	1·53
Oldham	...	...	...	13·351	13·101	3·186	1·191	3·288	2·316	9·981	74·75	7·665	3,158,752	1·5	1·544
Perth	...	...	...	9·39	8·81	3·08	·40	·77	1·46	5·71	60·79	4·25	295,846	1·25	1·17
Plymouth ...	...	...	4,037	12·066	11·450	2·42	1·11	1·29	2·298	7·12	60·83	4·82	1,159,069	1·66	1·38
Pontypridd ...	...	...	...	13·07	12·84	2·92	·76	3·84	1·85	9·37	71·7	7·52	631,981	1·28	1·48
Rawtenstall ...	...	...	...	10·11	9·699	2·40	·99	1·27	1·69	6·35	62·57	4·66	833,714	1·23	1·37
Rochdale... ...	4,284	...	...	11·292	11·134	2·611	·682	1·524	1·654	6·471	56·2	4·817	2,836,062	1·006	1·694
Rotherham ...	E. ... R.T....	...	1,500	12·37	12·37	3·11	1·15	1·65	2·46	8·37	67·65	5·91	1,669,691	1·25	1·96
Salford	...	12,265	22,000	10·623	10·622	3·112	1·011	1·144	2·050	7·317	66	4·972	9,602,534	1·22	1·667
Southampton ...	1,282	...	5,134	...	...	...	...	...	...	...	...	...	...	...	...
Southend-on-Sea	2,514	1,000	6,000	13·14	12·97	3·03	·85	1·33	2·33	7·54	57·35	5·21	848,538	1·75	1·33
Southport ...	...	...	...	10·303	10·227	2·483	1·213	1·395	1·521	6·612	63	4·958	465,241	1·5	·977
South Shields ...	...	3,194	2,400	10·308	10·160	2·392	1·352	1·075	1·780	6·599	62·4	4·652	1,200,086	1·353	1·293
Stalybridge, &c.	...	...	...	8·084	8·056	2·755	1·079	1·600	1·453	6·887	83·15	5·269	1,803.063	·9	1·614
Stockport ...	...	250	9,137	10·389	10·322	2·413	·923	1·604	·731	5·671	55	4·940	2,078,189	·512	1·348
Sunderland ...	...	...	5,000	12·210	12·148	3·198	·905	·786	1·820	6·709	54·75	4·8	1,802,694	1·5	1·21
Swindon	...	...	...	9·62	9·24	3·06	·89	1·65	1·99	7·59	79·29	5·60	277,568	1·6	1·24
Wallasey ...	...	4,500	(a) 8,000	12·048	11·896	3·499	1·252	1·160	2·018	7·929	65·8	5·911	1,851,649	1·4	1·44
Walsall	2,479	...	1,000	11·353	11·094	2·834	1·108	1·437	1·888	7·267	64·012	5·379	838 649	1·68	1·164
Walthamstow ...	...	...	...	8·75	8·66	3·02	·62	1·85	1·79	7·28	83·23	5·49	1,491,700	1·375	1·3
Warrington ...	2,498	...	...	12·334	12·193	3·305	1·377	1·615	1·790	8·087	64·22	6·208	531,700	1·5	1·193
West Ham ...	...	273	...	9·713	9·427	3·359	1·314	2·127	1·239	8·039	78	6·41	6,306,731	·75	1·66
West Hartlepool	...	3,018	...	9·77	9·52	2·39	·79	1·49	1·13	5·80	59	4·67	680,972	·78	1·42
Wigan	902	...	...	12·415	12·077	2·791	·866	2·052	1·736	7·445	59·70	5·80	2,186,073	1·187	1·461
Wolverhampton	...	...	3,744	11·239	11·091	2·648	1·267	1·746	1·463	7·124	62·5	5·661	1,712,796	1	1·45
Yarmouth (Gt.)...	...	...	...	7·927	7·752	2·618	·704	1·008	1·575	5·905	76·17	4·30	708,756	1·50	1·046
York	...	1,212	...	9·45	9.31	3·11	·92	·88	1·89	6·80	71·87	4·91	...	...	...

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Name.	Appropriation of Net Surplus.			Receipts per Car Mile.		Operating Expenses per Car Mile.					Per-centage of Operating Expenses to Total Revenue.	Average Operating Expenses per Car Mile (excludi'g Power Cost).	Board of Trade Units.		Works Cost.
	Carried Forward.	Reserve.	Contribution to Rates or Municip'l Funds.	Average Total per Car Mile. d.	Average Traffic per Car Mile. d.	Traffic. d.	General. d.	Repairs and Maintenance. d.	Power.* (Price paid) d.	Total. d.	%	d.	Units.	Cost per Unit. d.	Units used per car mile.
Belfast	...	...	12.185	10·08	9·93	2·83	·64	1·32	1·07	5·86	58·07	4·79	10,439,797	·658	1·39
Bexley	...	..	...	11·13	12·3	2·53	·85	2·82	·68	6·88	71·1	6·20	487,110	·827	1·66
Birkenhead ...	...	1,000	...	13·058	12·922	3·161	1·115	2·406	1·160	7·842	59·99	6·67	2,341,009	·60	1·936
Bournemouth ...	...	8,947	...	13·52	13·46	3·03	1·05	1·20	(b) 1·99	7·27	53·80	5·28	3,072,169	·65	1·69
Cardiff	10,002	...	...	12·354	12·14	3·843	·992	1·358	·835	7·028	59·1	6·193	4,936,582	·475	1·80
Coventry ...	103	...	...	9·902	9·734	2·971	·945	1·964	·778	6·658	67·2	5·88	1,651,950	·502	1·47
Glasgow	...	...	12,951	10·674	10·612	3·426	1·922	1·432	·515	7·295	59·87	6·266	33,848,947	·366	1·40
Huddersfield ...	8,400	...	...	11·05	10·79	2·92	·70	1·78	1·04	6·44	58·22	5·40	5,398,258	·49	1·93
Hull	...	4,574	10,000	8·61	8·53	2·87	·66	1·68	·61	5·82	67·58	5·26	6,352,263	·44	1·40
Leeds	...	...	81,567	10·936	10·834	2·914	1·016	1·099	·720	5·749	52·57	5·029	18,862,847	·668	1·918
Leicester... ...	...	...	480	9·875	8·682	3·425	·661	1·325	1·469	6·880	69	5·411	7,540,856	·420	1·82
London	...	...	...	E. 9·77 H. 9·51	9·50 9·03	3·24 4·17	1·14 1·64	1·49 3·41	1·02 5·15	6·89 14·37	68·78 151·17	5·69 14·37	152,666,477 ...	·615 ...	2·60 ...
N'castle-on-Tyne	...	25,757	18,000	12·187	11·642	3·297	1·063	1·293	1·015	6·668	53·02	5·653	11,259,266	·382	1·968
Northampton ...	...	652	...	10·89	10·70	2·94	1·10	1·08	2·13	7·25	68	5·12	1,189,423	1·24	1·57
Portsmouth ...	6,568	(i) 6,000	10,000	12·201	11·997	3·092	1·308	·824	·549	5·773	45·88	5·050	3,272,089	·483	1·139
Preston	...	5,041	1,300	10·75	10·54	2·890	1·168	2·164	·700	6·922	64·40	6·222	1,765,250	·407	1·49
Reading	...	1,005	3,000	9·520	9·242	2·165	1·131	1·119	·945	5·360	54·55	4·248	1,180,507	·740	1·15
Sheffield	...	9,032	22,876	10·747	10·666	3·277	·866	1·236	1·345	6·724	61·116	5·379	18,329,775	645	1·979
Wellington, N.Z.	15,431	...	...	16·309	16·189	5·974	·801	2·259	1·850	10·884	66·86	9·034	4,769,149	·906	2·05

* The figures given under "Power" in Table II. include actual works costs only. H—Horse lines. E—Electric trolley system. (a)—Debit balance forward £426.
(b) Including current supplied by Bournemouth and Poole Supply Company. (c) Horse account ·054d. (r) ·161 Army Service allowance. (f) Insurance fund.
(i) Including Insurance. (k) Insurance. (r) Renewals Fund. (s) Military Allowances &c. £2,567. (t) Amounts for 15 months.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Population Served.	Traffic Records. Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Traffic Revenue per Mile of Single Track. £	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Average Speed per Hour. Miles.	Average Total Car Hours per Day.	Average Number of Cars in Use Daily.	Number of Cars in Stock.
Aberdeen ..	165,000	1,909,009	24,048,816	12·59	·86	145·8	90	3,121	10/6	·514	1·861	·57	7·6	812	63	83
Accrington ..	45,525	573,536	4,998,979	8·72	1·377	109·8	105	3,033	13/1	·84	1·07	·929	7·5	250	18	27
Ashton-u-L.	50,000	477,155	4,886,149	10·240	·657	164·84	109	2,757	9/–	·392	1·223	·81	8	209	12	25
Ayr	33,000	447,725	4,019,771	8·96	1·02	122	103	1,832	10 5	·65	1·25	·75	8	168	12	22
Birmingham	870,000	14,232,902	149,443,199	10·5	1·03	171·8	86·63	5,384	14·9	·76	...	...	...	...	...	...
Blackburn ...	200,000	1,121,769	12,223,569	10·89	1·28	61·12	105	2,528	6/6	·902	1·25	·76	7·60	434	31	61
Blackpool ...	67,500	1,085,655	13,624,514	12·55	1·32	201·8	103	4,370	22,4	·79	...	...	8	...	29	84
Bolton ...	221,000	2,886,180	31,370,166	10·86	1·066	141·49	124·07	2,920	12/8	·582	1·553	·633	7·25	980	70	112
Bradford ...	370,000	6,194,057	70,077,271	11·31	1·059	189	113	2,807	16/6	·84	1·66	·530	7·3	2,402·5	155	252
Brighton ...	133,935	1,108,352	11,837,828	11	1·10	88·38	76·08	3,165	8/1½	·83	1·27	·787	6·41	512	32	53
Burnley ...	175,000	1,644,712	15,867,699	9·65	1·16	96	120	3,544	8/10	·88	1·25	·83	7	798	42	67
Burton ...	48,000	440,021	3,311,355	7·53	1·06	69	...	1,790	6,4	·95	1·505	·58	7·5	...	...	20
Bury	128,202	1,613,357	15,513,264	9	1·07	121·47	99·73	1,904	10 9	·554	1·30	·77	8·54	...	...	54
Chester ...	39,028	347,318	3,275,944	9·43	·95	83·9	95	2,009	6/5	·64	1·27	·8	7	144·57	10·04	18
Chesterfield	50,000	304,376	2,950,774	9·7	1·1	76	122	2,668	5/5	·78	1·38	·75	7·33	126	7	17
Colchester ...	65,000	332,963	2,434,786	7·31	1·32	37·46	86·80	1,689	4/1	·94	·85	·96	6·77	147·14	10·51	18
Croydon ...	181,956	2,803,883	19,847,402	7·08	1·062	109·08	128	4,983	9/9	·850	2·15	·50	8·23	933·60	60	75
Darlington ...	62,383	387,714	4,234,783	10·9	·76	62·15	96·5	1,499	4/4	·52	1·219	·45	6·66	151·25	11	18
Darwen ...	...	267,670	2,741,987	10·24	1·28	...	...	2,045	...	·97	...	...	...	...	...	...
Derby ...	124,000	E 1,217,304	12,414,263	10·20	1·003	100·1	...	2,359	8/4½	·73	1	·775	6·5	...	36	50
Doncaster ...	60,000	529,122	5,747,273	10·86	·955	95·79	93·9	1,798	7/7	·711	1·25	·76	7·5	239	18	32
Dundee ...	165,000	1,388,345	18,753,140	13·50	·851	113	...	2,345	8/–	·544	2	·50	7·3	...	...	72
East Ham ...	145,000	1,596,984	18,916,971	11·84	·75	130	...	4,192	8/2	·65	1·71	·63	...	...	..	...
Exeter ...	48,660	449,103	4,611,444	10·27	·93	95	...	2,566	7/4	·603	...	...	...	...	...	24
Gloucester ...	53,972	624,402	4,358,510	7	·92	81	90·60	1,113	6/2	·75	1·5	·65	7·08	250·8	19	30
Halifax ...	176,000	2,330,104	20,707,071	8·89	1·27	118	81·76	2,015	12/8	·852	1·553	·82	7·23	883·74	78	101
Ilford ..	88,000	945,433	9,203,077	10·48	·78	104·6	...	2,462	7/2	·613	1·543	·69	8	...	...	27
Ilkeston ...	32,000	241,548	1,746,382	7·2	·95	...	90	1,942	52/8	·8	1·50	·5	7	101	7	13
Ipswich ...	76,472	642,092	5,610,332	8·73	·975	73·4	64·4	1,532	6/–	·82	1·53	·693	5·47	322·56	20·16	36
Keighley ...	43,500	247,791	3,552,016	14·3	·68	...	55·2	..	4/1	·45	2·17	·459	...	18	7	12
Kilmarnock ...	36,000	278,987	2,311,708	8·28	·87	64·2	96·83	1,507	4/8	·712	1·13	·86	7·22	98·03	7·88	14
Kirkcaldy ...	39,600	448,469	5,492,120	12·24	·723	138	49	1,882	8/4	·5	1·522	·64	7	158	17	22
Lancaster ...	41,908	170,337	1,559,037	9·15	·852	37·20	75	1,153	2/8	·812	1·71	·5	8	84·7	6·05	12
Leith ...	110,500	968,808	10,220,069	10·55	·85	92·5	126	2,017	6/7	·53	1·32	·72	8·4	315	21	37
Leyton ...	124,735	1,813,462	17,472,882	9·64	·950	140	120	3,820	11/1	·791	1·77	·95	8·25	14·5	40·0375	60
Lincoln ...	20,000	148,440	1,713,542	11·5	·89	85·67	59·3	2,169	6/5	·552	1·75	·428	7	72	4	8
Liverpool ...	840,000	13,687,888	145,656,374	10·67	1·127	173·40	89·09	5,516	16/3	·772	2·514	·39	7·75	5,040	420	596
Lowestoft ...	35,000	307,838	2,706,348	8	1·07	77·32	70·25	2,787	6/6	·703	1·5	·7	5·75	192	12	19
Maidstone ..	25,000	300,945	2,423,514	8·053	1·03	96·94	82	1,478	8/4	·741	1	1	6·8	128	12	19
Manchester	957,500	19,155,051	202,768,420	10·6	1·06	212	93·5	4,835	18/7	·717	2·514	...	7·75	7·2	561	683
Nelson ...	45,000	192,378	2,484,775	12·92	·85	55·22	87·84	2,407	4/2	·665	1	1	5·5	108	6	11
Newport ...	90,000	964,895	9,410,109	9·75	1·09	104	...	2,909	9/3	·79	1·164	·898	...	...	...	44
Nottingham	264,000	3,789,857	41,210,964	10·87	1·02	156	95·28	3,984	13/4	·646	1·75	·442	6·92	...	109	155
Oldham ...	180,000	2,045,840	22,171,712	10·837	1·19	123·176	...	3,018	12/4	·92	1·13	·863	7	...	...	97
Perth	35,900	252,216	1,844,588	7·31	1·16	51	...	1,289	5/–	·78	...	...	...	...	...	...
Plymouth ...	112,000	838,142	9,333,087	11·13	1·027	83·33	...	2,666	7/2	·639	...	...	...	...	...	42
Pontypridd ...	50,000	426,639	5,478,483	12·84	1	121	80·18	2,852	40/–	·73	1·5	·53	6·16	221	17	26
Rawtenstall	40,000	605,485	4,869,792	8·04	1·21	122	111	1,540	12/3	·79	1·121	·88	8·50	247·5	15	24
Rochdale ...	130,000	1,772,546	14,286,607	8·06	1·387	109·90	110·30	2,085	11/11	·78	1·07	·90	7·33	660	44	69
Rotherham ...	64,000	E 850,548 RT ...	9,828,838 ...	11·55 ...	1·07 ...	153·6 ...	... ...	3,645 ...	13/1 ...	·72 ...	... ...	... ...	... ...	... ...	... ...	... ...
Salford ...	350,000	5,828,238	54,343,908	9·324	1·134	155	104	3,403	14/9	·78	2·20	·46	7·916	2,065·5	153	200
Southampt'n	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Southend ...	78,000	637,366	7,581,104	11·89	1·09	97·2	87	4,708	8/10	·634	1·41	·76	6·5	357	21	31
Southport ...	31,312	475,680	4,772,478	10·033	1·004	152·41	100	1,850	12/9	·7	1·6	·7	6·65	225	15	27
So'th Shields	110,600	927,728	10,479,421	11·296	·899	91	126	3,826	7/1	·58	3·1	·38	7·71	285	20	40
Stalybridge	94,091	1,116,936	8,406,915	7·706	1·06	89·3	...	1,353	8/–	·905	1·22	·72	6·8	...	...	60
Stockport	120,000	1,541,700	12,184,055	7·903	1·290	101·5	97·5	2,358	10/11	·726	1·333	·750	7·500	559	43	5(c)
Sunderland	170,000	1,486,201	18,619,364	13·2	·97	109·5	78·3	3,696	8/10	·536	1·34	·68	7	688	43	70
Swindon ...	53,000	223,383	2,392,470	10·71	·859	45·14	75	1,955	3/4	·709	1·2	·85	6	...	...	12
Wallasey ...	87,000	1,284,938	13,555,876	10·54	1·15	153·51	99·2	3,190	14/8	·75	1·89	·54	7	388·53	35·5	67
Walsall ...	100,000	720,634	6,752,727	9·371	1·184	68	94	1,905	6/7	·775	1·24	·79	7	315	21	39
Walth'mst'w	130,000	1,146,743	13,499,838	11·77	·732	103	104	3,089	6/4	·618	1·18	·86	7·6	430	37	38
Warrington	86,000	445,459	6,012,212	13·474	·903	69·91	102·24	2,344	5/3	·59	1·246	·803	6·39	180·99	11·937	21
West Ham	296,570	3,760,361	42,667,561	11·35	·852	144	90	5,041	10/–	·67	1·85	·50	7·66	1,195·75	93	118
W. Hartlep'l	90,000	479,382	4,261,917	8·89	1·07	47	94	2,163	4/3	·65	1·262	·94	7	203	14	26
Wigan ...	200,000	1,495,786	13,811,709	9·23	1·344	69	97·57	2,427	7/6	·802	1·15	·88	7·4	567	42	73
Wolverh'ton	135,000	1,181,309	12,236,785	10·359	1·06	90·64	89	2,539	8/1	·687	1·25	·879	6·85	651·6	36·2	52
Yarmouth ...	56,000	677,153	4,236,424	6·25	1·239	75·65	80	1,500	7/10	·944	1·25	·76	7	310	23	35
York	82,600	762,540	...	...	...	...	...	...	...	...	...	...	...	...	...	...

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast ...	390,000	6,432,600	62,340,269	9·74	1·02	159	128	2,689	13/8	·60	1·96	·43	8·75	2,014	241	290
Bexley ...	16,500	316,970	2,270,070	7·16	1·55	133	126	2,922	19/10	1·24	1·59	·63	9·5	179	11	16
Birkenhead	137,996	1,209,117	14,822,697	12·25	1·052	107·41	73·46	2,702	9/3	·992	1·39	·66	6·84	483·81	45·09	65
Bournem'uth	120,000	1,815,632	16,967,210	9·34	1·44	141	...	3,103	16/11	·78	1·19	·87	6·8	...	...	91
Cardiff ...	182,729	2,742,546	30,424,407	11·09	1·09	166	85	4,358	15/2	·85	1·44	·736	7·5	1,408	88	130
Coventry ...	135,000	1,100,553	8,730,024	7·9	1·22	65	59	2,832	6/7	·84	1·18	·866	6·2	487	41	51
Glasgow	1,150,000	24,214,460	336,260,758	13·887	·764	292·4	105·61	5,404	18/7	·488	2·31	·44	8·11	8,974·78	628·20	856
Huddersfield	160,000	(a) 2,797,276	23,933,065	8·69	1·24	159	84	3,556	15/6	·73	1·34	·69	7·72	1,012·16	63·26	106
Hull ...	291,118	4,551,145	52,087,770	11·44	·745	178·92	123·43	4,879	11/1	·52	2·75	·364	9	1,565·60	97·85	180
Leeds ...	525,000	9,522,737	95,639,268	10·04	1·075	182	115·43	3,747	16/4	(b) ·884	1·93	·539	7·54	3,465	230	345
Leicester ...	232,644	4,137,262	37,914,773	9·146	·947	163	108·35	4,045	12/10	·751	2·18	·45	8	1,451	...	160
London ...	...	E68,706,161 H 272,631	547,253,332 3,244,661	9·32 11·90	1·02 ·76	... ...	117·07 77·12	8,465 1,045	... ...	·73 1·21	... ...	... ...	8·95 5·85	17,972 131·80	1,374 10	1,730 37
Newcastle ...	300,000	5,775,323	65,085,452	11·27	1·073	217	...	4,454	18/8	·592	1·58	·633	...	...	...	223
Northampt'n	91,500	690,177	8,295,941	12·02	·89	90·66	...	2,470	6/8	·603	1·34	·7	...	...	...	33
Portsmouth	246,000	2,438,621	27,554,194	11·299	1·061	112·01	90·29	3,535	9/1	·495	1·66	·62	7	1,065	74	100
Preston ...	120,000	1,025,738	10,340,688	10·08	1·04	86·17	132	2,652	7/7	·764	1·01	·95	7·36	404·7	21·3	33
Reading ...	76,500	924,696	8,881,097	9·6	·96	116	114	2,704	9/4	·54	1·59	·68	7·5	336	25	36
Sheffield ...	485,228	8,810,252	107,023,195	12·147	·878	220	108·86	4,950	16/2	·553	2·917	·371	...	3,215·05	221·728	339
Wellington ...	70,000	2,328,849	24,565,376	11·28	1·43	359	85	4,708	44/10	1·031	1·125	·89	7·59	840	75	92

E—Electric trolley system. H—Horse lines. (a) Including 9,467 miles coal haulage. (b) Total expenses per passenger. (c) And 3 trackless cars.

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FINANCIAL REPORTS AND MEETINGS.

Liverpool Overhead Railway.—At the annual meeting on February 22, the chairman (Mr. H. C. Woodward) said there had been an increase in the passengers carried over the previous year of 16 per cent. first-class, 12 per cent. third-class, and 16 per cent. workmen, the total number being 15,082,502, creating a record. The receipts were £93,146, and after providing for interest on debenture stock the surplus was £24,041, while £7,013 was brought forward. A final dividend at the rate of 4 per cent. per annum was proposed on the ordinary stock, making 3¼ per cent. for the year, and carrying forward £6,873. The ordinary shares received 3 per cent. for each of the years 1914 and 1913, 2¼ per cent. for 1912, and 1½ per cent. for 1911.

Paisley District Tramways Company.—As the result of the trading for 1915, £6,500 has been placed to general reserve, £3,700 paid for half-yearly dividend on the 5 per cent. accumulative preference shares, and £1,000 placed to the preference share sinking fund for the first half-year. The directors now recommend that £3,750 be disbursed in cumulative preference dividend, £1,000 to preference share sinking fund, and £3,477 carried forward. Two years ago the ordinary shareholders received 1 per cent. The revenue for 1915 was £68,679, and the balance £19,477. Traffic showed an increase of £6,141, but expenses had largely increased due to the war bonus of 5s. per week, the cost of coal, and the increase in the price of all materials; £2,000 more than usual had been carried to general reserve to meet the cost of deferred repairs after the war.

Lancashire United Tramways.—The report for 1915 states that traffic receipts were £90,578, miscellaneous receipts, and electrical energy sold, £6,249. Less working expenses, £54,933; cost of generating electrical energy sold, £4,096; general charges (including direction, management, interest, etc.), £5,240; rent of leased lines, £5,191. Add dividend on holding in New St. Helens and District Tramways Company, Limited, £1,534; making profit of combined undertaking, £28,901. The interest and dividends received from the operating companies, together with sundry receipts, amounted to £14,017. After deducting interest on prior lien debenture stock and expenses, there remains £198, which has been carried to depreciation account. There is also a balance on the year's working of the operating companies, after payment of interest and dividends before-mentioned, of £16,203. The depreciation and renewal accounts and amounts carried forward in the combined companies now amount to £49,502.

Edinburgh Tramways Company.—Mr. B. Hall Blyth, who presided at the annual meeting on February 4, said it had been found that 5,000 of the 13,000 pulleys on the system were wanting or inefficient. Everything was being done by Mr. Cox, the new engineer, to overhaul the whole machinery before the end of March, and put the undertaking in as good a condition as ever it had been. A great many delays had taken place, and the late engineer accounted for them as being due to the new drivers, but, to a large extent, it was due to inefficient inspection and to lack of repairs. The company had been subjected to some abuse for increasing the fares, but with the large addition to the cost of working they were bound to consider the interests of the shareholders. He was in hopes of a satisfactory result to the negotiations for the Corporation to take over the undertaking. The report, which appeared in our issue of February 10, was adopted. Replying to a question, the chairman said that since the appointment of the women conductors, the collection of the fares had been better than before. The chairman also mentioned that although Mr. Shepherd's health had caused him to resign the post of general manager, the directors were glad to retain his services as secretary.

Tyneside Tramways and Tramroads Company.—Out of an available balance of £5,424 from the past year's trading, the directors recommended a dividend on the preference shares at the rate of 5 per cent. per annum, less income-tax (£601), and a dividend on the ordinary shares at the rate of 3 per cent. per annum, less income-tax (£2,008). They are placing £1,400 to reserve for renewals, depreciation, and other contingencies (which, with £496 interest on investments, will increase the fund to £22,562), and to the credit of special reserve account to meet contingencies, £500. To provide for loss on conversion of consols into War Loan, £288 19s. is allotted, leaving to be carried forward to next half-year, £525. The dividend on the ordinary shares for the whole year is at the same rate as for 1914. The traffic receipts decreased by £621 as compared with the corresponding half-year, and for the whole year there is a decrease of £1,043. At the annual meeting on February 8, Mr. T. Merz (chairman) said it was gratifying that the ordinary traffic had increased by 5 per cent., although the holiday traffic fell off by a matter of £1,400. The increased expenditure was largely due to repairs and upkeep of the line. The reserve fund had been increased by £3,399, of which £2,600 had been taken out of revenue, and £799 was interest on investments. They would have left for investment over £20,000. In 1914 they put £1,500 to a special fund in order to meet exceptional expenses, and they had added to it £500 this year. The meeting empowered the directors to spend a sum not exceeding £200 for the purposes of the war.

Sunderland District Tramways Company.—After providing for interest on the prior lien bonds and the first mortgage debentures, and for sinking fund instalment, and making provision for depreciation on investments, the net profit for 1916 was £1,759. To this must be added £644, brought forward, making £2,403, and the board recommended the payment of interest at the rate of 2½ per cent. per annum (less income-tax) on the first income bonds, which will absorb £1,752, leaving £651 to be carried forward. The traffic receipts showed a decrease of £522. Various economies in the working expenses had been effected, leaving an increase in the profit of £580. Mr. H. R. Hogg, presiding at the annual meeting, said that in the first three months of the war they lost £1,500 in receipts. For the past year the loss had only been £522. By a re-arrangement of what was not immediately necessary in their annual expenditure they had converted that loss into an excess of receipts of £580. The cars, buildings, overhead equipment, and permanent way had been kept up to the mark, but they had had to pay a considerably increased price for rails and tires, higher wages, and increased rates and taxes. The number of passengers was 4,515,568, as against 4,719,679. The car mileage was slightly reduced, and the ratio of costs to receipts came to 54·27 per cent., as against 56·84. The board would have liked to increase the number of cottages for the men's accommodation, but in view of the heavy cost of building they decided to postpone this during the war.

Liverpool Corporation Tramways.—In submitting the estimates for the year ending December 31 next, Councillor Russell Taylor (chairman of the Tramways Committee) said that for the past year it had been made possible to hand over to the rates £100,000 from the tramways profits, and £50,000 from the electric supply department, by the efficient working of Mr. Mallins, Mr. Dickinson, and the staffs under them. A vastly increased expenditure had been placed upon the tramways, but owing to the work that had been done, and the savings effected, the balance sheet showed in the net result only £11,000 below the prosperous year of 1914. They had carried free 4,984,469 soldiers, sailors, nurses, and doctors. The total number of passengers was 137,156,000, or 3,151,000 more. Owing to the forethought of the manager, the car mileage had been reduced by 995,274 miles. He appealed to the public to continue their consideration towards the tramways and their servants in case of an increase in the number of strap-hangers. If they reduced by 1-10th of a penny the penny fare paid by the 137 million passengers, it would lead to the wiping out of the profit handed over in relief of the rates, and possibly a loss. He warned the Council not to expect £50,000 next year in relief of the rates from the electricity department, as the coal bill was likely to be £22,000 more, in addition to which they would have higher wages and other extra expenditure. Alderman F. Smith said the changes introduced at Lambeth Road depot by Mr. Mallins enabled them to keep the cars in repair, and that had materially added to the result. The new electrical machinery, put in since Mr. Dickinson came, had reduced the cost of power.

Birmingham Corporation Tramways.—The accounts for 1914-15, recently issued in booklet form, show an increase in track to 118 miles 71 chains from 114 miles 44 chains. Traffic revenue increased by £12,075 and working expenses by £28,362. The gross balance fell by £16,829 to £173,135, and the net profit decreased by £28,375 to £47,596. Passengers increased by one and a half millions. These results are interesting in view of the higher fares that are being charged during the current year. Included in the capital account is an expenditure of £260,991 on street widenings, £39,439 of that sum being paid during the year under review. Appended is a two years' comparison of the chief items in the accounts: —

	1914–15	1913–14	Inc. or Dec.
Capital expenditure ...	£2,472,938	£2,334,437	+ £138,501
Loans outstanding ...	£1,940,158	£1,913,559	+ £27,599
Total track mileage ...	118 m. 71 chs.	114 m. 44 chs.	+ 4 m. 27 chs.
Traffic revenue ...	£640,091	£628,016	+ £12,075
Total revenue ...	£647,014	£635,471	+ £11,543
Working expenses ...	£473,879	£445,507	+ £28,372
Gross balance ...	£173,135	£189,964	- £16,829
Net profit	£47,596	£75,972	- £28,376
Passengers carried ...	149,443,199	146,930,986	+ 2,512,213
Average fare per passr.	1·03d.	1·03d.	—
Car mileage	14,232,902	14,268,244	- 35,342
Units per car mile ...	1·7	1·70	—
Power cost per car mile	1·912d.	1·913d.	- ·001d.
Receipts per single track mile ...	5·384d.	5·482d.	- ·098d.
Receipts per car mile	10·910d.	10·689d.	+ ·221d.
Expenses per car mile	7·991d.	7·494d.	+ ·497d.
Ratio of expenses to revenue	73%	70%	+ 3%

A reference to the motor omnibus accounts will be found on page 218

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Blackpool and Fleetwood Tramroad Company.—The annual report for 1915 shows a net profit of £18,131, after providing for debenture interest, and £2,977 was brought forward. A final dividend of 4½ per cent. is proposed, making 6½ per cent. for the twelve months (as against a similar amount the previous year and 8½ per cent. in 1913), adding £615 to the depreciation reserve and £5,499 to the general reserve, writing £995 off investments, and carrying forward £4,250. Mr. J. Greenwood presided over the annual meeting on February 15. He first apologised for the absence through illness of Messrs. Boddington and Barningham, two of the directors, this being the first time that Mr. Boddington had missed a shareholders' meeting during his seventeen years of office. In moving the adoption of the report, the Chairman observed that the receipts were within a few pounds of the previous year's account, and but for the increase in rates and taxes the expenses would have been reduced by £2,521. The net result was a saving over the 1914 accounts of £1,482. The convenience to the public at times was not what they would have liked to have provided, but the cause was the shortage of labour. With the vigilance displayed by the staff the compensation and law expenses were practically nil. Negotiations were proceeding for the renewal of the lease of the tramways from Dickson Road to Bispham, where the Corporation had in hand the question of the protection of the cliffs. If a reasonable renewal of the lease of the tramways was arranged the directors, with the consent of the shareholders, would give a fair contribution towards the sea defence work, although the company had the right to transfer their tramroad on to the roadway. That would bring the cost of supporting the highway foundation on to the road authority. The company paid the Corporation £1,000 a year for 1¾ miles of line leased from them, and they were open to negotiate for an extension of the lines at a higher rate. In all his experience he had not known a greater rent than the £676 per mile per annum that they now paid. Out of 92 men of eligible age when war was declared 72 per cent. had enlisted or attested, and 5 per cent. had been rejected. The manager was arranging to employ women as far as possible. Mr. R. H. Prestwich was re-elected a director. Votes of thanks were accorded to the directors, Mr. J. Cameron, the secretary and general manager, and his staff.

DIVIDEND ANNOUNCEMENTS.

Montreal Tramways.—A quarterly dividend of 2½ per cent.

Scottish Motor Traction Company.—A dividend of 7½ per cent. free of tax for the past year, £2,119 being carried forward.

Glasgow Subway Railway.—A final dividend of 1 per cent. on the preference shares, making 2 per cent. for the year.

Mersey Railway Company.—The net revenue for 1915 amounted to £21,442, compared with £21,279. It is proposed to pay interest of 1 per cent. on the B debenture stock.

City of Buenos Ayres Tramways.—A final dividend of 1s. 3d. per share, making 5 per cent. for the year, adding £4,200 to the amortization fund, and carrying forward £141.

British Empire Trust have received cable advice that a dividend of 2 per cent. has been declared on the capital stock of the Winnipeg Electric Railway Company for the quarter ended December 31, 1915.

Traction and Power Securities Company.—A dividend of 4s. 6d. per share, free of income-tax, on ordinary shares; a profit of £561 from sales of investments placed to reserve, and £8,579 carried forward.

Chatham and District Light Railways.—A dividend of 5 per cent. for the year on preference capital and 6 per cent. on ordinary capital. The revenue shows an increase of £9,865; expenses have also heavily increased.

London Electric Railway.—Dividend on the ordinary shares for the six months ended December 31 of ¾ per cent., making 1½ per cent. for the year, against ⅝ per cent. for 1914, carrying forward £12,303, against £11,547.

City and South London Railway.—Dividend on the 5 per cent. preference stocks for the six months ended December 31 of 2½ per cent., making 5 per cent. for the year. Last year no final dividend was paid on the 1901 and 1903 stocks.

Metropolitan District Railway.—Dividend on the 5 per cent. second preference stock for the six months ended December 31 of 1½ per cent., making 3 per cent. for the year, against 2 per cent., carrying forward £13,952, against £13,888.

Underground Electric Railways.—The revenue enables the company to pay full interest to December 31 on its 6 per cent. first cumulative income debenture stock and on its 6 per cent. income bonds and to carry forward about £38,500.

Central London Railway.—Dividends:—On the undivided ordinary stock for the six months of 1½ per cent., making for the year 3 per cent., against 2⅜ per cent., giving on the deferred 2 per cent. for the year, against 1¼ per cent., carrying forward £15,685, against £15,413.

PERSONAL.

Mr. H. R. Harper, Melbourne city electrical engineer, has had his salary increased from £1,000 to £1,250 per annum.

Mr. H. H. A. Curtis, of Lake Coleridge, New Zealand, has been appointed power station superintendent in the Tasmanian Government Hydro-electric Department.

Sir Charles A. Parsons, K.C.B., F.R.S., has been appointed a member of the Advisory Council by the Privy Council Committee, for Scientific and Industrial Research.

Mr. F. W. Bricknell, city engineer of Hull, and engineer to the tramways department, has been transferred from associate to full membership of the Institution of Civil Engineers.

Mr. G. Schofield, formerly constructional superintendent to West Ham Council, has been appointed chief assistant engineer to the Nairobi Power and Lighting Company, East Africa.

Mr. T. C. Winfield, works superintendent, West Ham Corporation, Tramways, on the recommendation of the Tramways Committee, has been granted an increase in salary from £250 to £275.

Councillor J. M'Caughey, J.P., has been appointed chairman of Belfast Corporation Tramways Committee in succession to Alderman J. Tyrrell, J.P. Councillor J. Warwick succeeds Councillor J. A. Duff as vice-chairman.

Mr. G. T. Milne, H.M. Trade Commissioner for Australia, will be paying an official visit to England about the middle of March. Manufacturers and others desirous of interviewing him should apply to the Director, Commercial Intelligence Branch, Board of Trade, London, E.C.

Major Fred Coutts, 5th Black Watch, general manager and electrical engineer of Paisley Tramways Company, was recently awarded the Territorial Decoration. This is given, the regulation states, as "a reward for long and meritorious service to officers of proved capacity." The qualifying period is twenty years, and not twelve years, as in the case of the efficiency medal for non-commissioned officers and men. Major Coutts's total service in the Volunteer and Territorial Forces extends to thirty years.

Mr. Andrew Nance is retiring from the management of the Belfast Corporation Tramways, and the Corporation have appointed him consulting engineer at a salary of £500 per annum. Mr. Nance was for many years general manager of the Belfast Street Tramways, which was one of the most successful tramway companies in the country. It made great progress under Mr. Nance's management, the annual receipts rising from £14,500 to £272,000, and good dividends were paid with unbroken regularity. When the Corporation purchased the undertaking in 1904 Mr. Nance was appointed general manager, and under his supervision the lines were electrified and extended. Considerable sums have been paid in relief of rates, a reserve fund of £200,000 has been accumulated, and payments to the sinking fund amount to £260,500. In July, 1914, Mr. Nance celebrated the jubilee of his tramway service. There are few tramway officers who can point to so long and so successful a career.

Mr. T. D. Courcy Meade, the city surveyor of Manchester, has died after a short illness. In the early part of his career Mr. Meade was engaged in railway construction in Ireland. In 1894 he received the Manchester appointment, in which he carried out many great works. In adopting upcast shafts for sewer ventilation, he utilised a large number of them as tramway standards.

Sir Charles Rivers Wilson, G.C.M.G., C.B., who died on February 9, after a distinguished career in Government service, became the first chairman of the British Electric Traction Company on its formation in 1895. He retired in 1911, but retained his seat on the board. He was also president of the Grand Trunk Railway of Canada, and had served on the Council of the Suez Canal and as chairman of the Rand Central Electric Works. Sir Charles was a vice-president of the Tramways and Light Railways Association, and was one of the subscribers to the memorandum of association. He was elected member of the Council and first president of the association in 1899, and when the association was reconstructed in 1906 he was elected a vice-president.

RAILWAY OFFICERS AND STAFF.

Lord Kenyon, a director of the Cambrian Railways, is in command of the Welsh Horse Reserve.

Mr. W. J. Shilton has been appointed general manager of the Buenos Ayres Midland Railway.

Colonel David Davies, M.P., chairman of the Cambrian Railways, is serving in France in command of the 14th Royal Welsh Fusiliers,

Mr. H. W. Thornton, general manager, Great Eastern Railway, has accepted the invitation of the President of the Board of Trade to become a member of the Railway Executive Committee.

Major S. G. Partridge, director of the Stationery Department at the General Headquarters in France, is a son of passenger guard A. G. Partridge, of Paddington, G.W.R. Before the war he was employed at the War Office, which he joined in 1900.

Lieut.-Colonel G. J. Baugh, R.E., who has been appointed deputy director of the inland water transport, prior to the war was the marine superintendent of the Lancashire and Yorkshire and London and North Western Railways joint steamship service at Fleetwood.

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Lieutenant A. E. Haynes, R.F.A., who was mentioned in Sir Ian Hamilton's final despatch on the Gallipoli operations, before entering the Army was assistant divisional locomotive superintendent at Leeds Midland Railway. Lieut. Haynes has been awarded the Military Cross.

Sergeant P. H. Forbes, formerly of the G.W.R. chief accountant's office, Paddington, now serving with the Royal Engineers Railway Transport Establishment (Military Forwarding Section) at the General Headquarters, has been mentioned in despatches for meritorious services.

Mr. H. R. K. Woodward, G.W.R. divisional engineer at Shrewsbury, on leaving to take charge of the Bristol division, was the recipient of a presentation consisting of a tea-tray, kettle and lamp, also a silver tobacco-box and a pipe, subscribed for by all grades of the Engineering Department.

Mr. F. Tatlow, of the Railway Executive Committee, is a member of the committee appointed by the Board of Trade to consider all questions relating to the distribution of coal and coke that may be referred to them from time to time by the board or submitted by the District Coal and Coke Supplies Committees.

Mr. W. Finchett, accountant of the Cambrian Railways, was on February 22 entertained at dinner by the officers of the company in celebration of the completion of fifty years' service with the company. Lord Herbert Vane Tempest, a director, who presided, handed Mr. Finchett a cheque from the board of directors.

WITH THE FORCES.

Corporal T. Fearing, of Bury Council electricity works, has been awarded the D.C.M. for brave conduct at the front.

Mr. Eric Smith, electrical engineer to the Santa Fé Railway, has returned to England and joined the signal company of the Canadian contingent.

Corporal Hunt, of the Manchester solid tire staff of the Shrewsbury and Challiner Tire Company, has won the Distinguished Conduct Medal in France.

Lance-Corporal B. J. Kenyon, a Wigan Corporation car conductor, has been given a Distinguished Conduct Medal for gallantry at Ypres, in May of last year.

Mr. C. W. Salt, borough electrical engineer of Torquay, who recently enlisted in the London Territorial Electrical Engineer Corps has been promoted corporal.

Chief Inspector Clarke, Lowestoft Corporation Tramways, who is one of the 27 employees serving in the forces, has been in hospital in England recovering from wounds.

Regimental Sergt.-Major B. Tripp, S. Lancashire Regiment, has received the Distinguished Conduct Medal. He enlisted from the Manchester works of the British Westinghouse Company.

Privates Jolly and Eglington, two Doncaster tramcar conductors, have been awarded the Distinguished Conduct Medal. The Town Council have forwarded a resolution of congratulation to them.

Sergeant C. F. Claxton, 6th Divisional Ammunition Column, R.F.A., who has been awarded the Distinguished Conduct Medal for gallantry in action, was a conductor on the Liverpool Corporation Tramways.

Motorman C. S. Farmer and **Conductor C. H. Morgan,** of the Birmingham Corporation Tramways, have been awarded the Distinguished Conduct Medal for gallantry at the front. Morgan has since been killed in action.

Private J. O'Connor, of the Manchester Regiment, formerly employed in the Corporation Tramways department, has been awarded the D.C.M. for conspicuous bravery under heavy fire. The medal was affixed to his tunic by the Lord Mayor of Manchester.

Sergeant-Major D. Harrop, who, until the war, was electrical engineer in the testing room at the Hyde Road depot of Manchester Corporation Tramways, has been promoted second-lieutenant in the 12th Loyal North Lancashire Regiment, in recognition of zeal, devotion to duty, and bravery in the field.

Inspector Lee, Colchester Corporation Tramways, has been home on furlough from the Royal Army Medical Corps in France, after a year's service. As reported in our issue of December 9, he was awarded the French Military Medal for distinguished conduct. It was fastened to his tunic by General Haig, now the British Commander-in-Chief on the western front.

Captain H. Sparks, Suffolk Regiment, and **Lieutenant A. C. Sparks,** R.E., sons of Mr. Charles P. Sparks, President of the Institution of Electrical Engineers, have won distinction in the war. The captain was decorated with the Military Cross by the King at the investiture on January 15, and the lieutenant received the Ribbon of the Military Cross from his corps commander in France on February 5, for gallantry following the night attack on January 11-12.

Private R. E. Bullough, a son of Mr. R. C. Bullough, general manager, Colchester Corporation Tramways, has been promoted from the ranks and received a commission in the South Midland Division of the Royal Engineers. Lieutenant R. E. Bullough joined the ranks at the outbreak of war, and was attached to the King's Liverpool Regiment. Mr. Bullough has now two sons—both civil engineers—who have commissions in the Royal Engineers.

Sergeant H. Neale, of the Norfolk Regiment, who was employed on the Bradford Corporation Tramways, has been killed in action in France.

TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.

COAL SHORTAGE AND TRAFFIC SUSPENSION.—INCREASE OF PASSENGERS.—LIGHTING RESTRICTIONS.—TRAMWAY HEROES.

On February 28, the second time this winter, the tramway service had to be suspended at the minimum traffic period owing to shortage of coal at the power-station. On this occasion the delivery of fuel has been impeded by the adverse weather conditions, but for some time the Electricity Committee have had great difficulty in purchasing a sufficient stock. The power was cut off from the cars for an hour during the afternoon. The number of passengers carried on the Corporation's tramcars and omnibuses shows a great weekly increase compared with last year. Up to February 26 the receipts for the year showed an addition of £127,309. As the fares were increased early in last year, the department should be well able to meet the extra expenditure entailed by the war. The tramways undertaking is reaping great benefit from their enterprise in developing what has now become the largest municipal motor omnibus business in this country. The receipts are now about £800 per week, an increase of over £150 as compared with last year. The new lighting restrictions were considered by the Tramways Committee on February 14, when Mr. Alfred Baker, general manager, reported that so far no difficulties had been encountered. It was felt that as long as the number of late passengers remained as large as now there would be no justification for any restriction. The Tramways Committee are considering the question of taking steps to perpetuate the memory of the men of the department who have fallen in battle.

GLASGOW.

TRAMWAYS AS A "MUNITIONS INDUSTRY."—RESTRICTED LIGHTING.—FEMALE DRIVERS AND CONDUCTORS.

The Tramways Committee have advised the Corporation to apply to the Ministry of Munitions to have the department declared a "munitions industry" under the recent amendment of the Munitions Act. In readiness for the operation of the restricted lighting order on February 25, the tramways department had painted the windows of the cars halfway down both on the upper and lower decks. Nearly 20,000 inside lamps had been dipped in a dark solution. This work was facilitated by the fact that the lighting is in three circuits, thus enabling one-third of the lamps to be removed at one time. The indicators and dash lights have also been dulled. The female conductors now number 1,180, and the experiment of women drivers is being continued with 25 young women. The Tramways Battalion are now in France.

LEEDS.

PROVIDING FOR INCREASED RUSH HOURS TRAFFIC.—EMPLOYEES' REQUESTS.—GROWTH OF THE UNDERTAKING.

In explaining to the City Council the arrangements made for the conduct of the tramway traffic in view of the increasing scarcity of car hands, Councillor R. A. Smithson, chairman of the Tramways Committee, stated that fewer cars would be run after 10 p.m. Since the earlier closing of various places of entertainment, there was a decreased traffic after 10 p.m. to the extent of about 30 per cent. On the other hand, the demand at early morning, midday, and at teatime was increasing, and the management had come to the conclusion it would be to the general benefit that cars should be diverted from late night duty and used to cope with the great demand earlier in the day. After interviewing a deputation of the tramways employees, the General Purposes Committee of the Corporation have decided not to recommend an increase of wages or any increase of the war bonus except in special cases. Mr. J. B. Hamilton, general business manager for the Corporation, lecturing on "The Romance of the Leeds Tramways" at the Philosophical Hall, observed that when he took up the appointment of general manager of the tramways some members of the committee informed him that the department had practically reached full growth. The revenue at that period was £221,253, whereas for the present year the anticipated receipts were £475,000. The sum of £1,678,000 had been expended on the undertaking, and its present value was £2,500,000, which might be looked upon as the profits accumulated during the twenty-two years of municipal ownership.

LONDON.

INCREASED USE OF TRAILERS.—DOUBLINGS AND WIDENINGS ON THE WOOLWICH ROUTE.

For nearly two years an extensive use of trailers has been made on the Embankment-Tooting route. On February 21 this means of facilitating traffic during the rush periods was introduced on the route running from the Embankment to the London-Croydon boundary. The orders for the construction of 150 trailers were placed prior to the war, but delivery has been impeded owing to the shortage of labour. Now that more of them are coming to hand, the advantage to the tramway service is very great. The women conductors are proving invaluable for taking charge of the trailers, although these vehicles have no top covers. Trailers will be introduced on the Tooley Street line to Greenwich and Woolwich as soon

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as alterations have been made to a former horse car depot in order to house them. Arrangements have been concluded to permit of doubling of the tramways in several places at Woolwich before carrying out street widenings, owing to the demand of the Arsenal authorities for improved transport facilities for their workers. In a short time the tramways department will have overcome the difficulty caused by lack of sufficient power to work the largely increased number of cars on this route. The Whitehall authorities are not blameless for the inadequate service, for not long since they vetoed the proposal of the Highways Committee to provide a second route by linking up the Lee and Eltham tramways.

MANCHESTER.

MOTOR VEHICLES ON THE TRACKS.—TRAFFORD PARK TRAMWAYS.

In connection with the holding up of tramway services owing to the breakdown of motor wagons, Mr. J. M. McElroy, general manager of the Corporation Tramways, has stated that almost every day there is a block on the lines, and the department had to send breakdown gangs to clear the track. Mr. McElroy says that if drivers of motor lorries would keep to their proper side of the road the effect would not be so serious. He advocates that there should be a bye-law to regulate this rapidly-expanding traffic, so as to avoid these frequent dislocations. An inquiry was recently held by the Light Railways Commissioners into the application of Mr. Marshall Stevens and others interested in the development of the locality for sanction to construct three light railways in and adjoining Trafford Park. Opposition was offered by the railway companies, Manchester Ship Canal Company, Lancashire County Council, Manchester Corporation, and Stretford Council. The ground of objection was that the railways were not in the public interest; it was also alleged that the promoters intended to give preference to commercial undertakings in the Park over those outside.

NEWCASTLE-ON-TYNE.

THE ESTIMATES.—RENEWALS EXPENDITURE.—ANOTHER SUBURBAN EXTENSION.

For the ensuing year the Tramways Committee estimate the income at £319,000, as compared with £324,000 for the year shortly expiring. The estimate for the latter period was £282,200, the difference being due to the war activity. For the ensuing year the expenditure is put at £196,300, as against an estimate of £160,300 for the current year, but the total outlay will probably reach £196,175 The estimated surplus is £35,000. The expenditure in 1916-17 out of the reserve and renewals fund is estimated at £19,277. The similar outlay this year will probably reach a total of £24,368. Tramway communication to the populous suburb of Benton was opened on February 27, when Councillor R. Mayne (chairman of the Tramways Committee), Mr. W. Bramble (Sheriff), and other representatives of the city made the first journey, together with Mr. E. Hatton, the general manager, and other officials. From Benton the tramways department's motor omnibuses provide an extension to Burradon and Annitsford. The usefulness of the new services brought about in linking the west and the east was explained by the chairman. The terminus at Heaton Road has now been joined up by a short line to the tramways already laid and used, and there are thus four routes to Benton—*via* Jesmond Road, *via* Shieldfield, *via* Heaton Road, and *via* Chillingham Road. This addition gives the people who live near Armstrong Park the opportunity of reaching Newcastle by way of Jesmond instead of through Heaton. As re-arranged, there are now through services from Scotswood *via* Heaton to Benton, and from Westmorland Road *via* Jesmond; Heaton Road, and back by way of Raby Street, Byker to Westgate Road. This, in short, gives an idea of the way in which the new connection gives alternate routes, linking up widely-separated parts of the city. There was formerly no traffic from Stanhope Street in the west to the Central Station, as the cars ran to Blackett Street and on to Byker, but the manager has now arranged a service in which the cars will pass the Central Station.

PLYMOUTH.

LINKING-UP WITH DEVONPORT.—THE ARBITRATION.

Some months will elapse before the Plymouth Corporation Tramways are linked up with the tramways recently acquired from Devonport Tramways Company. Alderman S. H. Phillips, chairman of the Tramways Committee, in reporting on the result of the arbitration proceedings between the Corporation and the company, stated that a great deal of arduous work had been done in connection therewith by Alderman J. C. Tozer, Councillors J. C. Brown and J. Moon. The award was for £103,970, in addition to which they would have to pay half the costs of the arbitration, £1,446; the costs of the Corporation, £5,500; and the stamp duty for conveyance, £1,040. It was estimated that after paying interest and sinking fund on the total sum, and devoting a large sum to the improvement of the line, there would be a profit of £4,000 in the year beginning April 1. They proposed to give the western part of the borough a more regular and quicker service with less fares in many cases, and to spend a considerable amount on the permanent way and the cars. In the old Plymouth area the tramways had never cost the borough a penny, but had contributed thousands of pounds to the rates, in addition to paying off a large proportion of the cost.

CONTRACTS AND ORDERS.

Leyland Motors, Limited, Lancs., have received a contract for the supply of motor lorry bodies to the War Office.

Derby Council have placed an order with the British Electric Transformer Company for the supply of a transformer.

Walsall Council have accepted the tender of Belliss and Morcom, Limited, for the supply of a 3,750 KW. turbo-alternator, at £13,227.

Keighley Tramways Committee have purchased a second-hand petrol chassis for conversion into a tower wagon, at a cost of £180.

Barford and Perkins, Limited, Peterborough, have received an order for the supply of a motor road roller to the War Department.

The National Steam Car Company, Limited, London, have received an order from Manchester Gas Committee for a 3-ton coke-fired steam lorry chassis.

The Midland Railway Company has again accepted the tender of the General Electric Company for the supply of Osram drawn-wire lamps for the ensuing twelve months.

Glasgow and Electric Wagons.—Before submitting a proposal to use electric tipping wagons for refuse collection, the Cleansing Committee propose to visit Birmingham, Sheffield, and Dover in order to inspect electric vehicles in use in those places.

The General Electric Company, of China, Limited, Shanghai, have for the sixth time been successful in securing the yearly contract for the supply of Osram traction-type lamps to the Shanghai tramways. This contract was secured in face of competition from the suppliers of many other makes of lamps.

Johannesburg Council have allotted the following contracts:—Supply and erection, complete on foundations, of two Babcock and Wilcox marine type water-tube boilers, with auxiliary plant, Reunert and Lenz, Limited, £10,700; supply of cable, Telegraph Manufacturing Company, £2,130; supply of cable, Henley's (S.A.) Telegraph Works Company, £1,108.

Manchester Electricity Committee have placed the following contracts:—

B. Thomas, one low-tension switchboard; Johnson and Phillips, Limited, low-tension cable; British Westinghouse Electric and Manufacturing Company, Limited, four 1,050-1,320 KW. rotary converters for sub-stations; Bruce Peebles and Company, Limited, two 1,050 KW. motor converters and two 200 KW. positive traction boosters for sub-stations; Mirrlees Watson Company, Limited, alterations and additions to condensing plants; Alton and Company, high and low pressure steam and water pipework; J. Hopkinson and Company, Limited, Huddersfield, valves; British Insulated and Helsby Cables, Limited, cables.

Beneficial Latitude.—Alderman F. A. Dunsford, chairman of Southampton Tramways Committee, at the February meeting of the Council, stated that a short time ago the committee were given sanction to purchase copper and rails, and they bought copper at £78, while it was now £122 per ton, £95 being obtained for the old metal. They also bought rails at £7 10s., which could not now be got under £14, and probably not at all. They had authorised the manager to purchase certain things, and he asked the Council to allow them a certain amount of latitude.

Sheffield Electric Supply Committee have adopted tenders as appended:—Supply of a turbo-alternator, C. A. Parsons and Company, £37,625; supply of three boilers and accessories, Stirling Boiler Company, Limited, £34,400; extension of condensing water service and constructing concrete discharge chamber at Neepsend power station, E. Taylor, Limited, £3,560; levelling site for coal storage and laying steam crane track, J. E. Nadin, £3,802; supply and delivery of six-panel, ironclad, h.t., two-phase switchboard for Forncett Street sub-station, A. Reyrolle and Company, Limited, £645 11s.

Glasgow Tramways Committee have accepted the following tenders:—Liverpool Electric Cable Company, and of Pirelli, Limited, for V.I.R. cable; British Westinghouse Company, for commutators; General Electric Company, Limited, and Edison and Swan Company, for traction lamps; Simplex Conduits, Limited, for lighting conduits and fittings. The City Council have been recommended by the Electricity Committee to accept the subjoined tenders:—British Westinghouse Company, Limited, one 6,000 KW. turbo-alternator and condensing plant, at £25,622, for the Port Dundas station; Willans and Robinson, Limited, one 6,000 KW. turbo-alternator and condensing plant (with Dick, Kerr alternator), at £25,480, for St. Andrew's Cross station.

FOR HIGH-CLASS
CONDENSING PLANT
WRITE TO
THE MIRRLEES WATSON CO., LTD.,
SCOTLAND STREET, GLASGOW.

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PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

Anderson, J.—Electro-magnets for brakes (1,811).
Babbington, F.—Mudguard for motor vehicles (2,567).
Barker, G.—Motor vehicles (2,811).
Birtill, G. S.—Increasing leverage on brakes automatically (1,438).
Caterpillars Tractors, Limited (*Holt*).—Endless tracks for vehicles (2,526).
Chavalier, F.—Anti-friction car wheel (1,601).
Couse, F. A.—Trolley wheels (1,842).
Deterding, C. A. G.—Tire for motor vehicles (2,181).
Ellison, G.—Electro-magnets for brakes (1,811).
Fraser, F. A.—Guards for road vehicle wheels (1,493).
G. and V. R., Limited.—Motor vehicles (2,130).
Geiger, C. A.—Truck or trailer for vehicles (1,880).
Lycett-Green, E.—Lighting devices for road vehicles (2,023).
Grice, A. G.—Motor vehicles (2,130).
Hayward, H. R.—Trolley head replacement devices (1,983).
Hollands, C. L.—Railway point and signal apparatus (1,747).
Howell, D. G. A.—Mudguards for motor vehicles (2,567).
Hutchins, T. L.—Joints of railway rails (2,670).
Jacobs, S. G.—Bodies of motor road vehicles (1,734).
Jensen, J. T.—Self-acting screw couplings for railway cars (2,187).

Killen, E. B.—Attaching or suspending under varying loads, axles, wheels, carriages, etc. (2,401).
McNeale, H. T.—Safety guards for motor vehicles (1,914).
Mingay, F. H.—Driving gear for motor vehicles (2,222).
Monts, P. de.—Road trailing vehicle (2,237).
Mozley, J.—Increasing leverage on brakes automatically (1,438).
Negrini, G.—Semi-automatic compressed air brakes (1,485).
O'Donnell, J. P.—Electrically-operated indicating apparatus for signalling on railways (2,266).
Powell, L. Jones.—Railway carriages and tramcars (2,376).
Rosenbaum, M.—Trolley wheels (1,842).
Ruffell, F. W.—Joining rails with fishplates and chairs (1,528).
Russell, R.—Accumulator-charging systems for vehicles (2,384).
Rymer, W. E.—Brake apparatus (1,947).
Sadler, S.—Control handle for motor-propelled vehicles (2,610).
Sharman, W. A.—Electrical signalling systems (1,921).
Snell, C. Scott.—Lighting road vehicles (1,714).

SPECIFICATIONS PUBLISHED.

1914.

Cleathero and Spurr.—Universal lifting and turning jack for mechanical vehicles (23,390).
Pallavicini.—Spring suspensions for vehicles (24,100).

1915.

Bell and Jones.—Locking arrangements for differential gears on the axles of motor wagons, etc. (5,204).
Boot and Scourfield.—Electric signalling systems (5,076).
British Westinghouse Electric and Manufacturing Company, Limited.—Electric motor control systems (12,340).
Bruce and Williams.—Railway sleepers and rail fastenings (1,680).
Cloud.—Fluid pressure braking apparatus (928).
Conradi.—Motor vehicles (9,994).
Cronk and Mottershead.—Ticket punches (3,252).
Gill (*Hatfield Rail Joint Manufacturing Company*).—Rail joints (8,407 and 12,123).
Höchstädter.—Stranded electrical conductors for overhead power transmission (1,234).
Hollands.—Point and signal mechanism for railways (391).
Kendrick.—Rail crossings (13,996).
Leeds Forge Company and Houldcroft.—Railway vehicles (1,759).
McDonnell.—Starting mechanism for motor vehicles (1,235).
Mears.—Chairs for railway rails (420).
Parkinson.—Anti-creeping devices for railway rails (9,752).
Porsche, Reik and Oesterreichische Daimler-Motoren Akt.-Ges.—Road vehicle trains (2,084).
Rendell.—Fluid-pressure braking apparatus (1,339).
Samuel, Slingo and others.—Brake for electrically-propelled vehicles (9,915).
Scott.—Motor vehicles (1,294).
Shuttleworth and Shackleton.—Electric transmission systems for motor vehicles (10,420).
Simms.—Motor-propelled vehicles (7,222).

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1915. WEEKS ENDED. Feb. 6.	Feb. 13.	Feb. 20.	Feb. 27.	1916. WEEKS ENDED. Feb. 5.	Feb. 12.	Feb. 19.	Feb. 26.	AGGREGATE. Wks.	1916.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	50,295	51,560	47,578	50,712	49,591	50,263	50,359	48,957	8	395,241	– 7,666
Auckland	22,164	(28 days)	...	...	22,868	(28 days)	...	...	28	148,708	+ 1,612
Burma ... ... Rs.	3,525	3,577	3,727	3,466	3,512	3,708	3,614	3,315	30	...	+ 6,658
Calcutta ... ... Rs.	64,894	66,435	62,934	64,281	68,107	65,433	68,165	66,877	...	488,670	+ 27,573
Madras ... ... Rs.	(2 weeks) 27,430	...	...	...	(2 weeks) 29,860	...	...	...	6	96,243	+ 11,427

Companies Issuing Monthly Statements.

	1914. Sept.	October.	Nov.	December	1915. Jan.	Feb.	1915. Sept.	October.	Nov.	December	1916. Jan.	Feb.	Wks.	AGGREGATE. 1915-16.	+ or –.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Brazilian Street Mkrs.	...	...	...	...	...	...	...	...	...	...	...	...	...	—	—
BrazilianTraction Mkrs	6,096,940	6241170	5929730	6,010,490	...	...	6,494,000	6793000	6336000	6,527,000	...	...	52	77,113,110	+3,761,632
Brisbane	28,031	28,783	28,600	30,890	29,620	...	30,360	31,880	31,120	33,980	32,280	...	5	32,280	+ 2,660
British Columbia $	650,516	661,000	648,485	674,063	...	...	517,022	538,826	562,782	603,667	...	...	26	3,240,146	– 758,753
Buenos Aires Pt. & C.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Buenos Ayres Lacroze	40,333	42,341	42,256	44,000	43,301	...	39,355	42,516	42,603	43,528	40,596	...	30	291,525	– 4,741
Cape Town	...	...	...	...	...	...	13,310	...	13,870	16,589	16,030	...	—	—	—
Carthagena& Herrerias	2,175	1,543	1,379	1,255	904	1,822	1,252	2,169	2,090	2,129	2,841	1,585	8	4,426	+ 1,700
Cordoba	12,384	12,904	12,468	12,091	...	...	13,213	13,433	13,785	13,025	...	...	34	124,148	+ 4,718
East India	1,980	2,007	2,029	1,839	1,914	...	2,054	2,069	2,065	2,062	2,015	...	26	12,531	+ 650
Kalgoorlie	2,864	2,525	2,414	2,905	...	...	2,997	2,675	2,611	3,018	...	...	52	33,420	+ 1,596
La Plata	3,598	4,540	4,540	4,452	4,540	4,016	3,894	4,405	4,545	4,564	4,533	4,346	8	8,879	+ 331
Lima	28,717	30,646	29,712	32,411	33,043	...	30,543	32,208	30,703	34,685	34,014	...	52	385,854	– 7,338
Manila ... ... $	116,300	125,750	129,000	132,500	...	...	123,946	124,131	129,447	141,350	...	...	52	1,495,534	– 108,031
Melbourne	..	...	...	...	...	...	61,211	...	...	72,658	...	...	—	—	—
Mexico ... ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Montevideo	25,226	26,500	27,081	28,605	32,459	30,008	25,070	27,167	28,407	31,305	34,252	32,502	17	126,466	+ 8,313
Port Elizabeth ...	...	...	...	...	...	...	2,927	...	3,110	4,360	4,193	...	—	—	—
Puebla ... ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Rangoon	4,119	4,600	4,405	4,459	4,689	...	4,445	4,886	5,028	4,492	4,763	...	5	4,763	+ 74
Toronto ... ... $	879,321	849,636	824,634	...	...	...	804,902	792,001	851,113	...	...	...	48	8,793,719	– 502,658
Winnipeg ... $	310,996	330,562	330,398	368,400	...	...	261,982	286,146	323,025	377,121	...	...	52	3,499,741	– 601,561

(Continued on page 214)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1915. WEEKS ENDED.				1916. WEEKS ENDED.				AGGREGATE.		
	Feb. 6	Feb. 13	Feb. 20	Feb. 27	Feb. 5	Feb. 12	Feb. 19	Feb. 26	Wks.	1916.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1.509	1.507	1.564	1.550	1.682	1.689	1.634	1.646	38	68.591	+ 4.534
Accrington Corporation	443	...	...	...	534	...	...	...	44	24.521	+ 1.014
Ayr Corporation	228	211	226	215	265	251	259	249	42	15.147	+ 1.078
Bath Electric	*	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1.206	1.139	1.199	1.180	1.389	1.360	1.372	1.326	47½	65.769	+ 6.086
Birmingham Corporation	12.266	11.922	12.251	12.140	15.352	15.277	15.529	14.545	48	690.085	+107.785
Blackburn Corporation	964	1.000	996	1.037	1.091	1.074	1.050	1.045	47½	59.547	+ 222
Blackpool and Fleetwood	346	278	283	290	370	283	288	273	8	2.572	+ 128
Blackpool Corporation	833	596	578	612	1.090	743	679	661	48	75.272	+ 2.943
Bolton Corporation	2.493	2.426	2.569	2.394	2.575	2.648	2.550	2.465	48	128.217	— 259
Bournemouth Corporation	1.685	1.680	1.781	1.755	1.886	1.907	1.818	1.690	48	100.719	+ 5.447
Bradford Corporation	5.553	5.981	5.710	5.618	6.215	6.046	5.936	5.653	48	306.124	+ 12.952
Brighton Corporation	786	766	801	768	882	888	851	725	47½	51.850	+ 1.064
Bristol	8.436	7.980	8.250	8.189	9.403	9.165	9.106	8.664	8	74.192	+ 7.385
Burnley Corporation	1.418	1.390	1.378	1.397	1.659	1.590	1.512	1.445	48	76.601	+ 3.163
Burton-on-Trent Corporation	265	249	254	256	273	225	220	216	48	13.649	— 386
Bury Corporation	1.172	1.103	1.213	1.151	1.232	1.235	1.209	1.153	47½	63.894	+ 470
Cardiff Corporation	2.428	2.404	2.439	2.349	2.685	2.613	2.712	2.509	47	128.550	— 107
Chatham and District	946	972	931	955	1.033	1.033	1.079	984	8	8.299	+ 751
Chesterfield Corporation	236	235	232	239	249	248	251	253	47	12.715	+ 170
Colne Corporation	208	216	219	255	241	235	228	218	—	—	—
Cork Electric	420	426	440	408	472	452	447	421	8	3.584	+ 176
Croydon Corporation	1.524	1.567	1.450	...	1.602	1.568	1.625	...	46	84.235	+ 5.552
Derby Corporation	903	875	903	873	1.082	954	1.032	858	47½	49.868	+ 2.381
Dover Corporation	244	238	235	237	254	244	247	236	47	14.463	+ 2.314
Dublin and Lucan	118	108	109	112	128	111	109	109	8	915	+ 5
Dublin United	5.621	5.422	5.426	5.100	5.912	5.599	5.749	5.547	8	46.956	+ 3.083
Dundee City	1.179	1.200	1.197	1.173	1.339	1.294	1.294	1.278	40½	55.312	+ 3.351
East Ham Corporation	1.248	1.268	1.197	1.218	1.172	1.162	1.211	1.141	47½	61.960	+ 5.577
Exeter Corporation	294	291	298	281	328	316	324	294	47	17.592	+ 1.023
Gearless Motor 'Buses	*	...	...	...	...	...	...	...	—	—	—
Glasgow Corporation	20.021	19 817	20.091	19.745	22.634	21.581	21.769	21.446	39	846.622	+ 64.351
Glasgow Subway	1.079	1.103	1.083	1.077	1.251	1.232	1.247	1.236	8	10.133	+ 1.218
Glossop (Urban Elec. Supply Co.)	105	105	109	109	134	125	127	106	9	1.169	+ 205
Halifax Corporation	1.897	1.892	1.904	1.957	2.093	1.925	1.890	1.867	46½	103.003	+ 1.013
Hastings and District	664	718	670	732	728	724	714	644	8	5.865	+ 289
Huddersfield Corporation	2.227	2.175	2.272	2.246	2.645	2.562	2.620	2.405	47	126.604	+ 17.141
Hull Corporation	2.966	2.926	2.985	3.011	3.094	2.993	3.089	3.118	47	147.043	- 840
Ilford U.D. Council	562	558	557	540	605	597	613	568	47	30.610	+ 3.391
Ilkeston Corporation	111	112	113	115	145	130	126	127	48	6.465	+ 408
Ipswich Corporation	298	358	359	354	449	474	495	450	46	25.617	+ 4.572
Isle of Thanet	238	226	212	228	224	239	230	198	21	5.361	- 957
Kilmarnock Corporation	147	143	144	142	165	156	161	150	41	6.894	+ 303
Lanarkshire	1.648	1.660	1.711	1.669	2.170	2.108	2.044	2.198	8	17.161	+ 3.071
Lancashire United	1.459	1.495	1.467	1.533	1.616	1.545	1.581	1.584	51	12.580	+ 829
Leeds City	7.925	7.632	7.978	7.935	8.957	8.553	8.790	8.438	48	426.145	+ 34.508
Leicester Corporation	2.747	2.733	2.769	2.766	3.072	3.143	3.241	2.975	8	25.952	+ 3.290
Leith Corporation	639	623	620	616	763	748	711	726	41	31.551	+ 2.662
Leyton U. D. Council	1.533	1.335	1.490	1.513	1.454	1.441	1.456	1.402	47	75.363	+ 9.059
Liverpool Corporation	12.639	11.940	12.213	12.131	13.338	12.837	13.004	12.479	8½	108.842	+ 8.011
Llandudno and Colwyn Bay	175	181	178	194	190	190	194	184	12½	2.333	+ 146
London County Council	45.591	46.816	44.663	46.281	44.290	44.255	44.691	44.285	47	2.086.074	- 6.484
London General Omnibus	*	...	...	...	...	...	...	...	—	—	—
London United	*	...	...	...	...	...	...	...	—	—	—
Lowestoft Corporation	131	144	142	141	117	118	124	125	20½	2.731	- 840
Maidstone Corporation	152	157	148	155	180	171	171	164	47	10.119	+ 507
Manchester Corporation	16.428	15.841	16.481	16.223	17.153	16.919	17.181	16.811	47	846.358	+ 31.259
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	—	—	—
National Steam Car	*	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	141	151	158	177	183	179	193	192	47½	9.272	+ 643
Newcastle-on-Tyne Corporation	5.621	5.660	5.611	5.566	5.957	5.633	5.662	5.571	48	293.606	+ 28.702
Newport (Mon.) Corporation	721	705	732	706	848	819	846	803	48	40.272	+ 1.976
New St. Helens and District	846	827	799	839	903	873	886	882	34	34.617	+ 3.446
Northampton Corporation	603	612	592	633	678	680	673	649	47½	34.191	+ 5.762
Nottingham Corporation	3.220	3.185	3.112	3.230	3.565	3.560	3.583	3.592	47	175.921	+ 14.123
Oldham Corporation	...	...	...	...	...	...	...	...	—	—	—
Portsmouth Corporation	2.083	2.021	1.968	2.013	2.182	2.061	2.189	1.833	48	116.385	—
Preston Corporation	827	847	806	819	992	982	990	959	47	46.124	+ 2.951
Provincial	1.816	1.747	1.795	1.829	1.990	1.930	1.954	1.826	21½	43.519	+ 3.224
Reading Corporation	643	657	634	659	736	722	763	696	47½	37.307	+ 4.071
Rhondda Tramways	1.074	1.075	1.048	1.102	1.223	1.186	1.161	1.147	8	9.325	+ 790
Rochdale Corporation	1.404	1.377	1.482	1.430	1.597	1.477	1.466	1.414	45½	80.251	+ 4.142
Rotherham Corporation	921	883	957	904	1.215	1.173	1.225	1.146	48	56.591	+ 8.133
Salford Corporation	4.582	4.527	4.694	4.449	4.934	4.990	5.041	4.793	47½	247.634	+ 11.963
Sheffield Corporation	7.844	7.603	8.133	7.763	9.442	9.383	9.501	9.067	48½	439.981	+ 62.436
Southampton Corporation	1.160	1.197	1.133	1.194	1.389	1.387	1.409	1.396	47	70.653	+ 8.565
Southend-on-Sea Corporation	560	617	570	622	574	582	564	561	47	37.318	- 8.021
South Metropolitan Tramways	*	...	...	...	...	...	...	...	—	—	—
South Shields Corporation	669	670	663	655	735	722	713	719	47½	37.514	+ 1.857
Sunderland Corporation	1.297	1.287	1.331	1.253	1.481	1.419	1.477	1.445	48	71.948	+ 2.505
Sunderland District	468	463	498	555	565	545	541	575	17	9.625	+ 897
Swindon Corporation	152	164	156	168	183	181	181	172	47	9.263	+ 874
Torquay Tramways	353	372	387	421	414	410	416	360	8	3.297	+ 233
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	—	—	—
Tyneside Tramways and Tramroads	498	476	493	508	524	503	489	490	8	3.878	- 3
Wallasey Corporation	1.049	995	1.035	1.013	1.141	1.090	1.106	1.084	47½	59.998	+ 1.620
Walsall Corporation	679	641	684	639	906	787	774	663	9	6.566	+ 1.061
Walthamstow U.D. Council	724	686	678	702	765	751	788	733	48	41.856	+ 3.972
Warrington Corporation	414	422	412	414	486	470	496	481	47	21.990	+ 1.470
West Ham Corporation	2.729	2.776	2.659	2.773	2.979	2.954	3.005	2.882	47½	145.738	+ 12.495
Wigan Corporation	1.366	1.373	1.346	1.396	1.438	1.475	1.544	1.543	47	71.686	+ 2.960
Wolverhampton Corporation	980	951	967	987	1.105	1.109	1.083	812	48	53.864	+ 3.387
Yorkshire (West Riding)	1.524	1.511	1.399	1.481	1.555	1.701	1.515	1.437	9	14.463	+ 1.709

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officals and the principal particulars relating to each undertaking.

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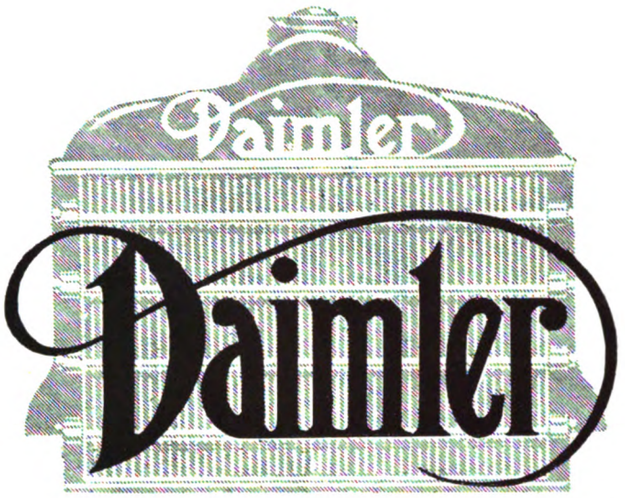

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MANCHESTER Corporation.
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Lanarkshire Tramways Co.
East Surrey Traction Co., Ltd.
Whitehaven Colliery Co., Ltd.
Greenfield Mill Co., Ltd.
Joshua Hoyle & Sons, Ltd., Manchester.
Coventry Metal & Iron Co., Ltd.
Joseph Evans & Co., Ltd., Birmingham.
CHESTERFIELD Corporation.
ROTHERHAM Corporation.
WALSALL Corporation.
Mansfield & District Tramways.
United Automobile Services, Ltd., Lowestoft.
John Croysdale & Sons, Ltd.
Alfred Hickman, Ltd., Bilston.
Galloways, Ltd., Manchester.
Ewarts, Ltd., Dudley.
Christopher Collins, Ltd., Birmingham

To secure quick delivery time is saved by stating, when enquiring, exactly the work on which the vehicle will be used, for every application must be sanctioned by the War Office before delivery can be given.

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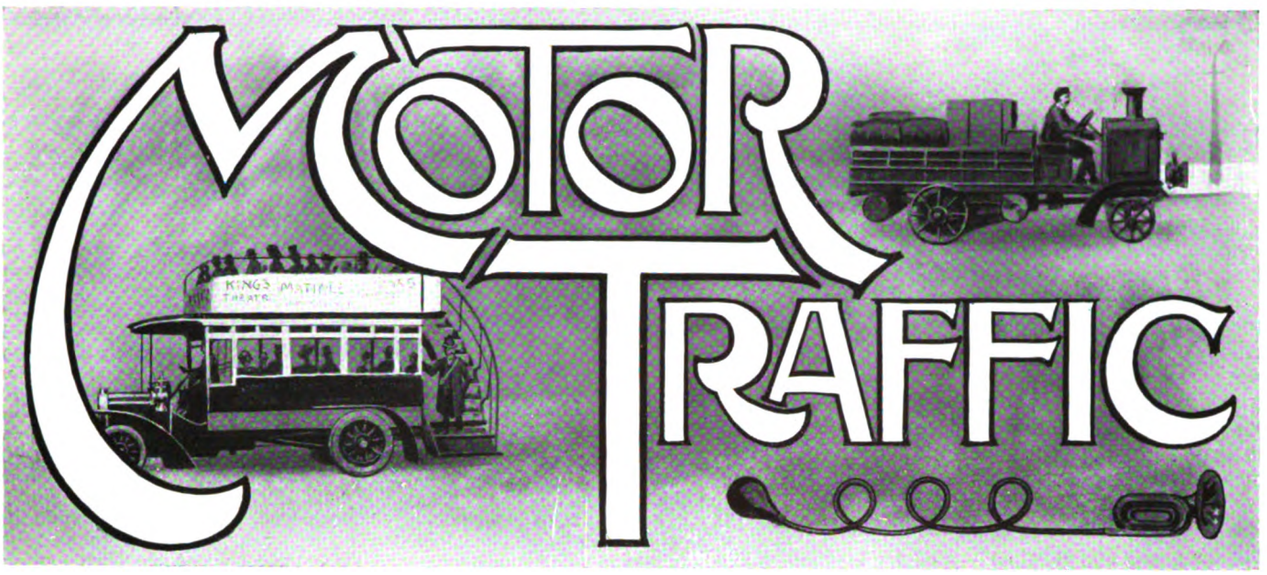

The recent developments in the matter of petrol prices are both confusing and serious. It is most difficult to account for what has taken place. The "Shell" people are evidently facing something in the nature of a shortage due to the fact that, according to their own statement, they are supplying five times as much petrol for Government purposes as their competitors. In view of this, they not unnaturally suggest that motor users should be as economical as possible. Digressing for an instant to a matter that is perhaps to a greater degree one for the consideration of private motorists rather than the owners of industrial vehicles, this would seem to amount to a hint that the large slow-speed American type of engine is not exactly the right thing to be used in this country nowadays. The point only concerns our readers as such so far as they may be contemplating the purchase of new vehicles—and particularly of light vans—and so far as it may be possible to save petrol by careful carburetter adjustment and good driving. The proprietors of "Pratt" spirit apparently are not suffering from any shortage of supplies, but realising that this happy state of affairs does not apply to the "Shell," it is to be assumed that they see an admirable opportunity of getting the bulk of the business at almost any price they choose to fix. Hence the sudden rise that has caused petrol of the lightest qualities to touch 2s. 6d. a gallon. Now the suppliers of "Shell" and "Crown" spirit are in a rather awkward position, not altogether unlike that occupied for some time past by British industrial vehicle manufacturers. Owing to their Government contracts, they cannot supply all civilian demands, and they are in danger of their goodwill being diverted into other hands. In view of this, it is evidently in their interests to obtain at least the moral support of the motoring community, so that when the time comes there may be a strong tendency in many quarters to go back to "Shell" even if, as is more than probable, the prices of the various spirits are then equalised. In this position they have apparently considered it the best policy not to join at once in any further increase in price, but to retain 2s. 2d. as their top limit. This is satisfactory so far as it goes, but unfortunately it does not go far enough, and in view of the possibilities of still further taxation petrol users who are not secured by fairly long-distance contracts are not unreasonably nervous.

* * * * * *

The number of vehicles in municipal service continues steadily to grow, and the war does not appear to have checked developments in this respect to any degree. The demands of public services are usually of so imperative a character that they must be met by some means or another. Many corporations and local authorities found themselves in serious difficulties at the outbreak of war owing to the extensive requisitioning of their horses, and, in many cases, of their motor vehicles as well, and not all of them have yet succeeded in filling up entirely the gaps thus created. Horses have become scarce and dear, and thus if the requirements of municipal work were to be met at all it became necessary to buy motor vehicles, even for services wherein the advantages of mechanical as against horse haulage had not previously been universally acknowledged. The shortage of labour, too, has been a powerful contributory factor, and the necessity of adopting methods that gave the maximum of work done for the minimum number of men employed has become more vital as time has gone on. Thus, with horses unobtainable, except on more or less prohibitive terms, and increasing trouble in obtaining men, motor vehicles have been purchased, not only in spite of the various official requests for economy in expenditure, but in order to comply with such requests. These vehicles once having been purchased, however, it is essential that they should be worked to the utmost advantage, but there is reason to believe that in the majority of towns and cities this desirable end is far from being achieved. The prevalent habit of municipal organisations of resolving themselves into so many watertight compartments may seem to work tolerably well in practice, but when it is extended to the purchase, running, and upkeep of motor vehicles its advantages are merely theoretical and its drawbacks intensely real. This, however, is the system that prevails, with very few exceptions, almost everywhere, and the practical result is that many thousands of pounds of public money is being expended beyond what is strictly necessary. Municipal motor "fleets" have grown in a somewhat haphazard way, and with such rapidity that it is difficult to realise that the period of experiment is not so very long past. Even now there is considerable difference of opinion, not as to the advisability of utilising mechanical transport, but as to the exact form that it is best to employ—petrol, steam in one or other of its varying forms, or electric. As a matter of fact there is, more often than not, scope and need for all three.

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MOTOR TRAFFIC.

In the foregoing circumstances, motor vehicles having definitely taken their place in the municipal scheme, the obvious next stage is that of utilising their capabilities to the utmost advantage. To secure this, it is necessary that in every town or area the question of motor transport as it affects the activities and undertakings of the local authorities should be considered separately and as a whole. In cases where local authorities have a tramway committee the organisation is a simple matter; the motor vehicles come naturally under the care of that committee, and form a department under the direction of the tramways manager. This has already been done with excellent results in several towns. In towns where there are no tramways a transport or "traffic" department should be set up, with its own committee, under whose charge should come every vehicle of whatever kind in the authority's service. Such a committee might normally consist of representatives of all the other departments, with someone having special knowledge of motor vehicles and haulage at its head. It should be responsible for the purchase, maintenance, and use of every van, lorry, or car of any description. The application of this method to the many and various vehicles used in municipal services generally is a necessary step, and is merely applying a principle that has worked excellently, and, indeed, been found indispensable, in private undertakings. It might be urged that the diversified character of the work to be done in corporation service would create difficulties, but this contention will be found to be largely based on preconceptions inevitably arising out of the "watertightness" previously referred to; and in any case the variety of requirements in the case of one of the larger retail stores, or a business like that of Messrs. Lyons and Company, the caterers, are certainly not less than those of the average public authority. The management of a large fleet of motor vehicles is a business in itself, and where a number of cars are in use, under no general control, but worked in small groups, each in the charge of someone to whom their running and maintenance is merely one of a number of duties, it will inevitably be found that they are giving less than the maximum of return for the money spent upon them. In the ordinary way it might not appear to be a favourable time in which to alter existing arrangements, but the centralising of municipal transport and haulage should commend itself in these times as a useful step towards greater efficiency of vehicles and men and consequent substantial saving of money.

BIRMINGHAM OMNIBUS SERVICE.

Its Importance to Munition Work.

The corporation and company tramway undertakings in connection with which motor omnibus services have been inaugurated during recent years have found the additional facilities of untold value for the conveyance of munition workers. In recent issues we have described the great and increasing use that is being made of the Sheffield Corporation omnibuses. Not less noticeable is the experience of the Birmingham Corporation Tramways Department in that work of national importance. At the February meeting of the Corporation, Councillor Harrison Barrow, chairman of the Tramways Committee, said there was an enormous demand awaiting the new omnibuses recently ordered, particularly for munition workers' transport.

Apart from the requests for new or increased services, the vehicles in use at Birmingham—the Tilling-Stevens petrol-electric machines—enjoy great popularity on account of the absence of jerkiness in starting and stopping. The fleet is 41 strong, a number that marks it out as the largest running under the control of a local authority in this country. In the exercise of a commendable foresight the Corporation, in 1914, took over the local omnibus company's business within the city boundary, while continuing to give the company facilities for bringing through traffic into the city from numerous outside towns and districts.

The Corporation omnibus service was inaugurated on the Selly Oak to Rednal route on July 19, 1913, and on a turnover of £5,092 to March 31, 1914, the sum of £1,682 was carried to profit and loss account. For the year ended March 31, 1915, the accounts show a gross profit of £4,549. On the capital account the expenditure totalled £7,843. On the revenue account the outlay during the year was £18,826, equal to an average of 9·108d. per car-mile. Of that total traffic expenses came to £6,925, and repairs and maintenance £5,965. The income totalled £23,376, equal to an average of 11·310 per car mile. The expenditure on repairs and maintenance was slightly less per mile run than for the preceding year, notwithstanding the addition of the undertaking of the local omnibus company, including omnibuses and reconstruction work at garage. This acquisition accounts for a sum of £32,176 as the only item in the tramways suspense account, while the reserve fund account includes on the debit side the item of £1,658 for "reconstruction of Bournbrook depot, including new motor omnibus garage." The subjoined table provides some interesting comparisons:—

BIRMINGHAM CORPORATION MOTOR OMNIBUSES.

Year ended March 31, 1915.

		Average per mile run.	
	1915	1915	1914
	£	d.	d
RECEIPTS—			
Traffic receipts	23,181	—	—
Other receipts	195	—	—
Total	£23,376	11·310	12·357
EXPENDITURE—			
Petrol	4,576	2·214	2·566
TRAFFIC EXPENSES—			
Wages of inspectors, drivers, conductors, and other traffic employees	4,943	2·302	2·187
Cleaning and oiling	1,109	·537	·509
Fuel, light, water, etc.	576	·279	·236
Ticket check	106	·051	·055
Uniforms	181	·087	·086
Miscellaneous	10	·005	·059
	£6,925	3·351	3·132
GENERAL EXPENSES—			
Rents, rates, and licences ...	780	·377	·507
Printing and stationery	108	·052	·050
Law charges and compensations	110	·053	·002
Insurances	91	·044	·036
Stores expenses	146	·071	—
Miscellaneous	8	·004	·013
	£1,243	·601	·608
REPAIRS AND MAINTENANCE—			
Buildings and fixtures	127	·061	·013
Workshop tools, etc.	141	·068	·075
Rolling stock	5,698	2·757	2·894
	£5,966	2·886	2·982
NATIONAL INSURANCE ACT, 1911—			
Employers' contributions ...	66	·032	—
Allowance to employees O.H.M.S....	50	·024	—
Total	£18,826	9·108	9·288
Balance	£4,550	—	—

	1915.
Percentage of operating expenses to total revenue ...	80·54%
Average operating expenses per omnibus-mile (excluding petrol cost)	6·894d.
Omnibus mileage	496,038
Passengers carried	3,333,653
,, ,, per omnibus mile	6·72
Average fare per passenger	1·37d.
Operating expenses per passenger	1·35d

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MOTOR TRAFFIC.

OMNIBUSES AND ROAD MAINTENANCE.

A conference of representatives of the Birmingham Public Works, Tramways, and Watch Committees has been held to consider the effect of motor omnibus traffic on the city roads and the maintenance of the thoroughfares. The following resolution was adopted for recommendation to the respective committees :—" That the Tramways Committee be requested to furnish the Public Works Committee with a schedule of the roads which, in their opinion, should be reconstructed with a view to carrying motor omnibus traffic, and that in future the Tramways Committee should not run any motor omnibuses on any other road without first giving six months' notice to the Public Works Committee." It is understood that this resolution is not to apply to special services established for the convenience of workers engaged on Government work during the war.

Great damage has been caused to the main road between Barrow and Ulverston by the running of motor omnibuses, although considerable expenditure has been incurred in the effort to maintain the thoroughfare. Many of the passengers are munition workers. An intimation has been received by Lancashire County Council that the Local Government Board will sanction the raising of a loan of £10,000 for carrying out repairs. The Main Roads and Bridges Committee, according to Councillor Aspell, their chairman, are of opinion that an effort should be made to get some portion of the cost from the proprietors of the vehicles.

Representatives of Lancaster Corporation and of Lancashire County Council have for some time been considering the question of the maintenance of roads in the borough for which the county authority are responsible. The conference was the outcome of the application recently made by the Corporation for powers to run motor omnibuses.

Birmingham Motor Omnibus Company have arranged to run a service into Lichfield on the same conditions in regard to road maintenance, etc., as those obtaining in the districts affected by Walsall Corporation Act.

NAPIER LORRIES IN MALTA.

The illustration on this page is a reproduction from a small snapshot recently received from Driver Corner, M.T.A.S.C., who is at present stationed at Malta, and throws an interesting sidelight on the daily work of a lorry on war service in Malta. In the course of a letter to Mr. H. T. Vane, managing director of D. Napier and Son, Limited, he says :—" I enclose a snapshot of a Napier lorry which, with many others, is doing excellent work here. The photo. shows the lorry in a flood which occurred in the recent severe storm. Your lorries are a marvel in going through such strenuous work, working from first thing every morning until last thing at night, and very often all night. People at home cannot understand the amount of work being done here, and I am afraid they never will unless they see it with their own eyes.

" We have 25 of your lorries, and the work they do consists of conveying stores all over the island to the different forts and barracks, conveying washing from the hospitals and barracks to laundry, conveying mails from lighters at the wharf to post office and storehouse, conveying wounded sitting-up cases from the hospital ships to different hospitals, conveying convalescents from the hospitals to the convalescent camps. Every night one Napier lorry is detailed to take a certain picket to different places. Napiers are used for all sorts of jobs, and the heavy loads they take along the country roads—mere cart tracks—and the hills they climb are marvellous. They are a very nice car to drive, and it is child's play to change the gears. They require very little attention."

Napier Lorry in a Flood at Malta.

THE NEED FOR NON-SKID RUBBER TIRES.—While a motor omnibus belonging to the Northern General Transport Company was passing through Chester-le-Street, on the night of February 5, it skidded from the left to the right side of the road and across a very broad footpath. A soldier and a woman who were standing on the path sustained injuries to their legs.

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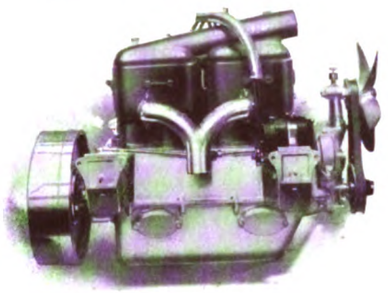
MOTOR TRAFFIC.

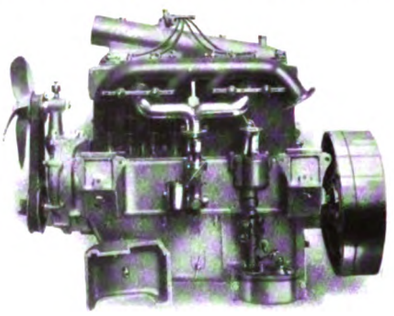
THE HALLEY CHASSIS.

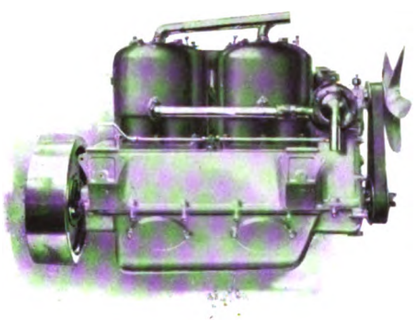
"Halley History" is the title of a 50-page art publication issued by Halley's Industrial Motors, Limited, of Yoker, Glasgow, and 46-52, Vauxhall Bridge Road, London, S.W., Manchester, Newcastle-on-Tyne, Liverpool, Montreal, Melbourne, and Sydney. Halley vehicles are used in municipal service, fire extinction, and for commercial and industrial purposes at home or abroad. There has been a marvellous development of the business since it was established in 1901 to undertake the manufacture of steam vehicles. The works and head offices at Yoker cover many acres; the number of employees has risen from a small total to over eight hundred; and the output has increased twenty-five fold.

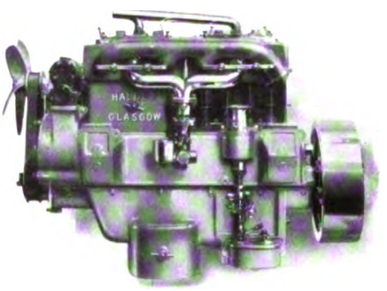
in the purchase price, and discerning buyers, who, we maintain, now very greatly predominate, know this as well as we do." From the beginning an adequate supply of replacement parts has been maintained, and the company take particular care to record all changes of ownership brought to their notice.

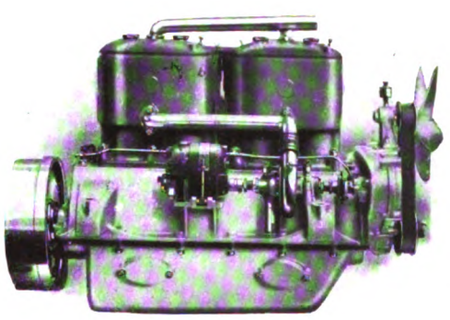
More than half of the book is required for "The History of a Halley Chassis," some stages in which we are able to illustrate. The standard 3-ton chassis is the model in principal demand. The engine design embodies the use of cylinders cast in pairs, giving greater rigidity of the engine as a whole, a marked reduction in the number of connecting pipes, joints, etc., and the admissibility of more efficient water-jackets, as compared with the practice of employing a single casting for the four cylinders. The twin arrangement permits the removal of the cylinders without the use of lifting tackle.

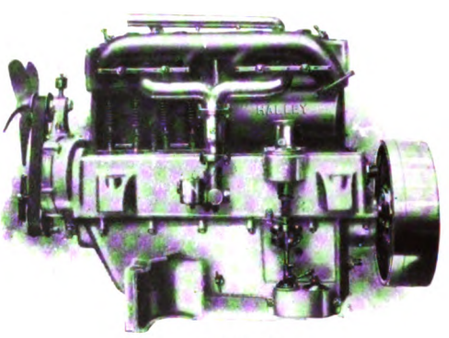












Near Side View. Off-Side View.

Halley Engines of 25, 35 and 45 H.P.—Fitted as Standard to Vehicles of from 1½ to 6 Tons Capacity.

The Halley petrol machine has been evolved since 1905 from a very successful Halley steam wagon. In 1907 the Royal Automobile Club held the commercial vehicle trials, in which two Halley vehicles took part, with the result that one gained the gold medal and the other the silver medal, the company also securing the special award for accessibility, simplicity, and freedom from liability to breakdown. Their reputation has become worldwide, alike for the excellent work of their chain-driven chassis overseas and in heavy work in this country, as well as for the performance of live-axle vehicles in passenger work and for light or medium loads of goods.

A chapter devoted to "Halley Policy" may be summed up in the following quotation:—"A motor lorry that has to bring to its owner a certain and definite return on the amount paid for it must essentially have more to recommend it than any questionable saving

A great amount of delicate work has to be executed upon cylinders fresh from the foundry before the engines present the finished appearance shown in the appended near and off-side illustrations.

No better testimony to the reliability of the Halley crank shaft could be forthcoming than the statement that only one breakage has occurred. The four stages of manufacture from a solid bar of nickel chrome steel are shown on the opposite page. This and all other parts are subjected to rigorous examination and test before being taken over by the stores department. Another indication of the care used in these works is that the cam shaft is turned from a solid bar, and not from drop forgings. The importance of the work of the cam shaft will be appreciated from the remark that it has to raise and lower eight large engine valves, controlled by heavy springs, one thousand times per minute.

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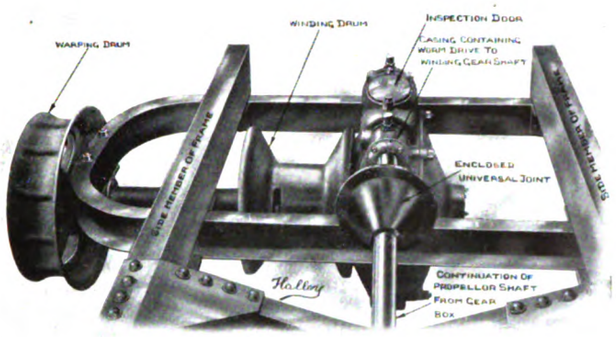
MOTOR TRAFFIC.

Every Halley engine is fitted with a governor, so set as to prevent the engine speed being greater than 1,000 revolutions per minute. To this method of preventing drivers from travelling miles per hour



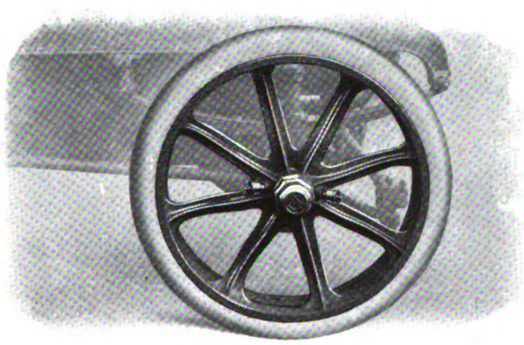
Combined Hoisting and Winding Gear.

Halley 3-Ton Gear Box Fitted to Type B Chain-Drive Models.

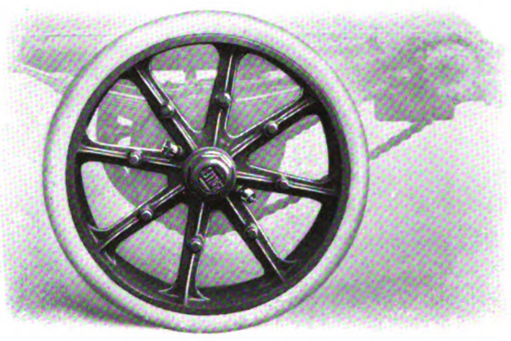
in excess of the designed speed is attributed the proven lasting qualities of these engines.

From the erecting shop the finished engine is transferred to the testing department, where it is run for twelve hours from shafting. If this proves satisfactory, the engine is run under its own power by petrol, with all the accessories of a chassis. By means of a dynamometer a load is applied until the engine is developing its full power at 1,000 revolutions per minute, at which it is kept at full load for twenty-four hours. It is then dismantled, and every part is subjected to minute scrutiny.

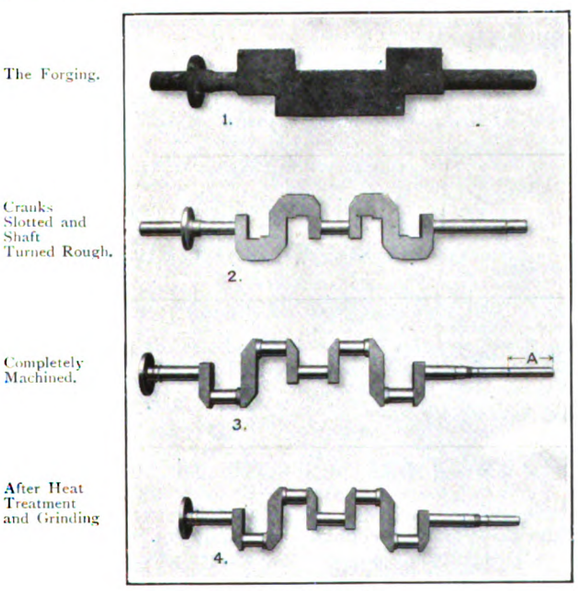
The appended view of the gear box shows the device fitted to type B chain-drive models, having three speeds and reverse. From the start Halley's refrained from attempts to stiffen up a pleasure car gear to suit industrial use, and their original method has proved highly successful. They claim that their gear box remains, after a ten years' test, the finest piece of machinery found in any motor vehicle designed for heavy service. When the live axle was introduced for passenger or rapid goods delivery, the company arranged a gear box with a direct drive on "top gear," in order to secure the fullest benefit from the greater silence obtained with the worm-driven live axle as compared with the chain transmission. They are thus able to offer vehicles peculiarly adapted to any circumstances.



Front Wheel.



Rear Wheel.



Halley Crank Shafts.

For much other interesting information our readers should consult the brochure itself, but we may mention that every chassis is given a test on the road, extending to about ten days. From 400 to 500 miles are traversed on the flat and on gradients, and until the chassis can show a satisfactory test sheet it remains at the works.

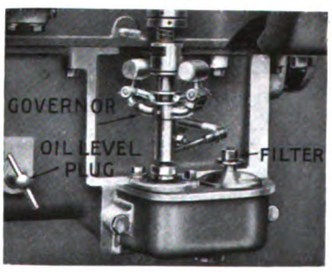


Illustration from Halley Book of Working Instructions, Showing Governor, etc.

Colonial users are catered for by certain departures from standard, including increased road clearance and the substitution of 35 and 45 H.P. engines for those of 25 and 35 H.P. An addition to standard is shown on this page in the illustration of the combined hoisting and winding gear.

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MOTOR TRAFFIC.

TWO DAIMLER LORRIES.

The accompanying photographs show two Daimler commercial vehicles recently delivered to two well-known manufacturers. The lorry supplied to Messrs. T. Mandleberg and Company is

a 3-ton machine, and that purchased by the Dukinfield Bleaching Company is a 2-ton vehicle. These illustrations are of particular interest to prospective buyers at the present time, as they show the standard War Office type bodies. Daimler lorries can now be supplied to firms engaged on Government contracts, but inquirers

should state fully the work on which the vehicles will be used, as every order must be sanctioned by the War Office before delivery can be given.

DECREASE OF LONDON LICENCES.

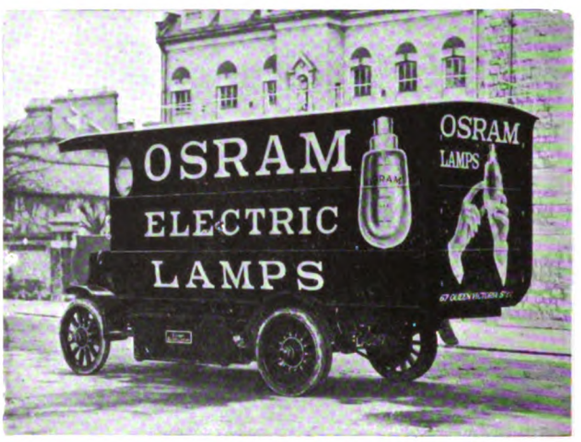
In the House of Commons the Home Secretary, on February 17, informed Sir H. Norman that the numbers of London licences for drivers and vehicles issued in July, 1914, and January last were as follow:—

	Jan., 1916.	July, 1914.
Motor cabs	5,813	7,746
Horsed cabs	946	1,666
Omnibuses	2,707	3,876
Tramcars	2,733	2,850
Hackney drivers	9,164	11,935
Stage drivers and composite	10,082	11,581
Assistant Conductors	12	25
Conductors	10,290	12,553

NEW SHEFFIELD SERVICE.—The recently instituted motor omnibus service of the Sheffield Tramways Department from Firth Park terminus to Ecclesfield is apparently proving successful.

THE "OSRAM" ELECTRIC VEHICLE.

We give below an illustration of the "Osram" electric vehicle which has lately been added to the fleet of express delivery motors employed by the General Electric Company for the delivery of Osram lamps to all parts of the United Kingdom. This van is handsomely finished in dark blue and presents a striking appearance. The gross weight is 2 tons 12 cwts., of which the Edison accumulator accounts for 16 cwts. The wheel base is 10 ft. 8 in. A load of two tons can be carried, the accommodation being sufficient for between 11,000 and 12,000 standard Osrams. The average



Edison Accumulator Vehicle.

speed on the flat is 10 miles per hour, and between 40 and 45 miles can be covered on one charge. Recharging is effected by a dynamo at the Osram-Robertson Lamp Works in Hammersmith. In addition to rheostatic braking, a system of band brakes is provided.

U.S.A. MOTOR INDUSTRY.

Mr. A. Reeves, secretary to the National Automobile Chamber of Commerce, United States, has recently published the following statistics concerning the American motor industry:—

American motor car production for 1916 will exceed	1,200,000
On the basis that any person with an income of £240 can own a car in the U.S.A., there is market for automobiles to the number of ...	5,000,000
Motor vehicles sold during 1915	892,618
Retail value of cars and industrial motor vehicles sold in 1915 ...	£138,355,790
Passenger (pleasure) cars sold in 1915	842,249
Retail value of passenger (pleasure) cars sold in 1915	£115,171,290
Motor trucks (industrial vehicles) sold in 1915	50,369
Retail value of commercial motor vehicles sold in 1915	£25,184,500
Motor car sales almost doubled from 1907 to 1908, from 44,000 to ...	85,000
Number of carriages sold annually from 1908 to 1912	1,000,000
Automobile exports to 80 different countries in 1915 exceeds	£20,000,000
In 1914 it was	£5,701,493
England is the best buyer of U.S.A. automobiles, taking for the year ended June 30, 1915, commercial motor vehicles, 5,306; pleasure cars, 8,321; valued at	£4,200,000
Estimated value of exports of commercial vehicles only, 1915 (increase)	£12,600,000
Estimated value of exports of pleasure cars during 1915 (increase 90 per cent.)	£7,400,000
Freight car loads of automobiles shipped during 1915 exceeded ...	200,000
Petrol consumed annually by automobiles (average of 400 gallons per car), gallons	980,000,000
Lubricating oil consumed annually (average of 12 gallons per car), gallons	28,800,000
Tires used annually on motor cars	12,000,000
Number of brands of tires used on motor cars, almost	125
Number of types and sizes of tires	140
Motor vehicles registered in the U.S.A. from State reports July 1, 1915	2,070,000
Total registrations for 1915	2,400,000
Registered in New York State December 1, 1915	231,713
Miles of public road in the U.S.A.	2,273,000
Money spent in U.S.A. on highway construction last year, which made for tremendous increase in real estate values, almost	£50,000,000

MOTOR OMNIBUS COSTS IN LONDON.

Although the report of the London General Omnibus Company for the past year does not state the number of omnibus miles run, and it is consequently impossible to arrive at the cost per omnibus mile from official figures, we believe that the working expenses have averaged 8¾d. per omnibus mile. Assuming this figure to be correct, there has been an increase in expenses of 1¼d. per omnibus mile in comparison with the previous year. In the circumstances, the result must be regarded as highly gratifying.

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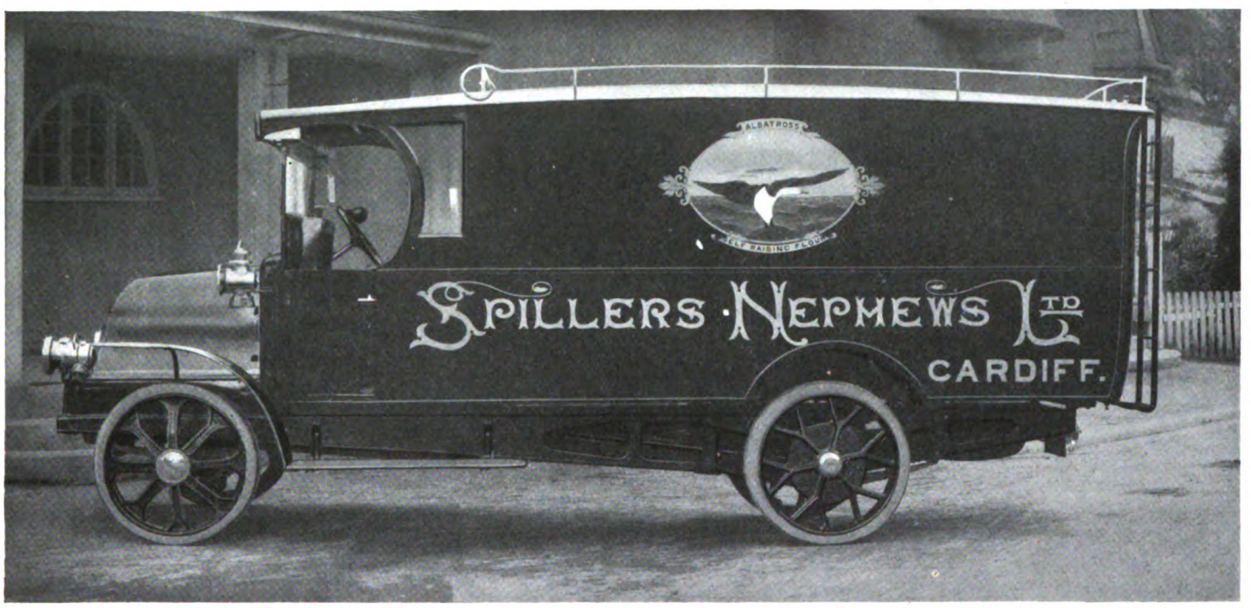
MOTOR TRAFFIC.

AN AUSTIN DELIVERY VAN.

One of the latest type delivery vans of the Austin Motor Company, Limited, Birmingham, is shown in the accompanying illustration. The body is mounted on a 2-3 ton Austin lorry chassis, and is handsomely finished. The design of the chassis embraces a number of distinctive features. The frame is of open girder construction. A novel arrangement of springs gives suspension, and at the same time ensures an unusual degree of lock for the front wheels, while the transmission and breaking stresses are taken up without undue strains upon the rear springs. The front springs are located within the frame line, and are of the usual laminated semi-elliptic type. The rear arrangement, however, is a complete departure from the usual practice. Two pairs of springs are used, one of each pair being placed below and the other above the axle, which, as will be noticed from our illustration, passes through the open work of the frame.

A special feature in the design of the front wheels is the fact that they are so dished that the pivots are located directly over the points of contact between the tires and the road, thus ensuring easy steering and the entire absence of protruding hubs. The wheel base is 11 ft. and the ground clearance 12 in. The chassis has a turning circle of 42 ft. The trade mark that appears on three sides of the van has been executed in its natural colours. The general colour scheme is tan brown, with black mouldings and gilt lines, and the whole decorative scheme makes a very effective advertisement for the owners. The convenience of the low loading platform is well illustrated in the photograph both as regards utility and general effectiveness. This feature of the design is specially notable.



Austin Lorry with Low Loading Platform.

PROVINCIAL DEMAND FOR OMNIBUSES.

New licences have been granted to Barrow Tramways Company for running motor omnibuses.

Lanarkshire Tramways Company have ordered four additional omnibuses, which will be put into service in March.

Manchester Tramways Committee have received the sanction of the Treasury to borrow £5,000 for the purchase of omnibus chassis.

At the February meeting of Birmingham Corporation, Councillor Harrison Barrow, chairman of the Tramways Committee, said there was an enormous demand for the motor omnibuses that had been ordered, particularly for munition workers' transport.

Halifax Tramways Committee have been directed to obtain estimates for the supply of two motor omnibuses. Tenders have been received for petrol, steam, and electric wagons for ash removal, but, before coming to a decision, the committee are obtaining information respecting battery vehicles in use elsewhere.

MOTOR VEHICLES FOR MUNICIPALITIES.

Rotherham Council are considering the advisability of purchasing more motor vehicles.

Ilford Council have placed an order for a 2-ton electric lorry for the use of the Tramways Department.

Cambridgeshire County Council have purchased two motor cycles for use in connection with highway work.

Salop County Council are allowing a sum of £25 a year to the Health Visitor towards the upkeep of a motor cycle.

Hyde Council have requested the War Office to agree to Leyland Motors, Limited, delivering a motor fire engine that had been ordered by the Corporation.

Marylebone Council have received a report from the Works Committee stating that it would be inexpedient to sell any of their horses at the present time with a view to substituting motor traction.

Rotherham Council have requested the chairmen of five committees to report as to the advisability of making arrangements by which the carting of the Corporation might be done by motor traction.

Manchester Gas Committee, who were the first provincial authority to purchase a coke-fired lorry, have ordered a second 3-ton coke-fired steam lorry chassis from the National Steam Car, Limited. These machines are in use by Hammersmith Council and by five gas companies in the London district, one company employing seven.

Sheffield Cleansing Department have recommended the purchase of a third electric vehicle for the work of the department. This is in consequence of the successful operation of the two Edison accumulator tipping wagons that have been in use since September, 1915, and the early part of January, 1916. The immediate purchase is declared to be necessary owing to the shortage of labour and the congested state of the work of clearing ashpits.

Hampshire County Council two and a half years ago provided a motor car, at a cost of £267, for the use of the inspector of weights and measures in the Basingstoke division of the county. The report of the General Purposes Committee for the year ended December 31, 1915, gives the following particulars of the cost of running the car :—

	Miles Travelled.	Cost of Running. £ s. d.	Cost per Mile. d.
Year ended June 30, 1914 ...	5,500	56 11 6	2·46
Year ended June 30, 1915 ...	5,350	52 15 10	2·36
Half-year ended Dec. 31, 1915 ...	2,505	26 5 6	2·51
Total for 2½ years	13,355	135 12 10	2·43

The running cost included petrol, lubricating oil, tires, repairs, and incidental expenses, including insurance. For depreciation no allowance has been made.

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MOTOR TRAFFIC.

Poplar Council have been advised by the Electricity and Works Committees to purchase a 4-ton Edison accumulator wagon and a 4-ton Foden steam wagon, each with a tipping body. The vehicles are required in order to effect the clearance of the increasing quantities of ash and clinker from the electricity and dust destructor works. At present the material is carted to shoots, where it is handled a second time, but owing to the shortage of men and horses, and the high price of fodder, the work has got into arrear.

MOTOR TRAFFIC NOTES.

Transit Needs Around Woolwich.—Great success has attended the inauguration of motor chars-a-banc services between Sidcup, Eltham, Woolwich, and Dartford. War workers are the chief passengers, the return fare between Sidcup and Woolwich being sevenpence.

New Wood-Milne Depots.—In order to meet the rapidly increasing demand for their tires, Messrs. Wood-Milne, Limited, have opened depots at 21, Albion Street, Gathorn, Manchester, and at 94, Albion Street, Leeds. Facilities for fitting solid tires are provided at each depot.

Folkestone-Dover Motor Service.—Railway communication between Dover and Folkestone having been interrupted by a landslip, a half-hourly motor omnibus service has been instituted at a fare of 9d. for the single journey and 7d. if a book of tickets is taken. The railway fare was 6d.

Petrol and Motor Taxes.—At a meeting of the Council of the Association of Municipal Corporations, held on February 17, a request was received from the Institution of Municipal and County Engineers to support an application to the Chancellor of the Exchequer for exempting local authorities and their surveyors from the payment of the increased duty in respect of motor spirit and local taxation licences. The Council resolved to take no action.

Liverpool-Manchester Transport Company.—Owing to the inadequate railway facilities available between the Liverpool Docks and the Manchester district, the cotton manufacturers have been greatly inconvenienced. To overcome the difficulty they have organised the Cotton Industries Motor Transport Company, Limited, with offices at 4, Norfolk Street, Manchester, under the management of Mr. W. A. Cocking. It is proposed to garage a fleet of ninety vehicles in the horse tramway depot at Chorlton Road.

Erith and Omnibus Powers.—On February 23, Woolwich Borough Council received an intimation from Erith Urban Council stating that they had decided to amend their application for powers to run motor omnibuses by asking for powers to run within the borough, and asking whether the Council's conditional consent, previously given, would apply to the amended application. The clerk was directed to reply that the Council would require information as to the route or proposed routes before giving consent to the amended application.

Women Ambulance Drivers in London.—Since December last the Metropolitan Asylums Board have employed women as drivers of their motor ambulance vehicles. On February 8 the London County Council agreed to make an experiment in staffing with women one of the ambulance stations under the control of the chief officer of the Fire Brigade. This service, which deals with street accidents, etc., was instituted last year. The women, who will receive the same wages as are paid to the male drivers, will undertake the entire charge of one ambulance and its station.

Speed and Mileage Ratings of Electrical Vehicles.—The American Society of Automobile Engineers have adopted the following recommendations of the Electric Vehicle Division with regard to standard ratings in connection with the mileage and speed of electrical motor vehicles :—

Electric vehicle speed ratings shall be based on continuous operation with one-half load over hard, smooth, and level roads or pavements at the actual average battery charge.

Electric vehicle mileage ratings shall be based on a continuous run at the S.A.E. rated speed with one-half load over hard, smooth, and level roads or pavements.

The Mud-Splashing Question.—The chairman of the Eastern District Committee of Stirling County Council, at their February meeting, stated that he had brought the question of mud-splashing by motor vehicles to the notice of the County Councils Association, and that it was being considered by the Departmental Committee on Locomotives and Heavy Motor Cars. While awaiting the report of that committee, the surveyor has been authorised to experiment with a set of guards attached to a motor car. The guard comprises an iron ring fastened to the spokes of the wheel by clips. Attached to the ring is a circular rubber flap, which revolves with the wheel nearly on a level with the tread of the tire.

LONDON GENERAL OMNIBUS COMPANY.

At the annual meeting of the shareholders held on February 24, the Chairman (Mr. C. J. Cater Scott) stated that the report and accounts were the first issued since the agreement constituting the common fund was entered into under the powers of the London Electric Railway Companies Facilities Act, 1915. The parties to the agreement were the City and South London, Central London, London Electric and Metropolitan District Railway Companies, and their own company. For the year under review their proportion of the common fund was 40 per cent. The gross receipts amounted to £2,882,410, a decrease of £344,129 as compared with 1914. After making allowance for depreciation of leases, plant, machinery, etc., and reserve for contingencies and renewals, there was a balance of £271,519. The balance from last account was £64,547, and the interest, discounts, and dividends on investments, £50,440. The interest on the 4½ per cent. first debenture stock was £44,045, and on the 5 per cent. cumulative income debenture stock, £50,000. The amount credited to the 4½ per cent. first debenture sinking account was £10,954, and £10,000 had been written off preliminary and liquidation expenses. There had been a loss of £9,664 on realisation of investments through the general depreciation, while the conversion of consols into 4½ per cent. war loan stock resulted in a further loss of £6,513. The amount written off discount on issues of debenture stocks was £10,236. Those items totalled £141,413, leaving a balance of £245,093 carried to profit and loss account. For the half-year ended June 30, the directors declared an interim dividend, free of income-tax, on ordinary shares of 6 per cent., and it was recommended that a further dividend of 6 per cent., free of income-tax, be paid. The further dividend would absorb £114,661, leaving a balance of £23,237 to be carried forward. Those dividends compared with 16 per cent., free of income-tax, for the year 1914, and the carry-forward was reduced by £41,310. The serious depletion of the staff and the large number of omnibuses taken by the Government had placed additional responsibilities upon those who remained behind, and those responsibilities were increased by the darkness of the streets at night. The time had come when they could not maintain the present services with the men available. The management had therefore made arrangements for training women as conductors.

In their fourth annual report the directors state that an agreement had been entered into between the Omnibus Company and the several railway companies whereby the common fund authorised by the Act was established. For the year ended December 31 last the gross traffic receipts of the five companies were £4,924,245, the gross aggregate receipts being £5,481,144. The amount retained by the several companies for "revenue liabilities," as defined in the agreement, which include working expenses, prior charges, reserves, and other items specified in the agreement, was £5,029,778. The balance of £451,365 was credited to the common fund authorised under the Act. Under the terms of the agreement the company were entitled to 40 per cent. of this fund, and accordingly received £180,546. Plus £64,547 brought forward from last year, there was a total of £245,093 available for dividend on the ordinary shares. The company's gross receipts were £2,882,410, and the expenditure £2,412,142. After appropriating £198,747 for depreciation of leases, plant, machinery, furniture, etc., and reserve for contingencies and renewals, the balance at credit of revenue account was £271,519. With the balance from last year and the sums received from interest, discounts, and dividends on investments, the total balance was £386,507. From this amount £141,413 was deducted for interest on the three classes of stock and for preliminary and liquidation expenses, loss on realisation of investments, etc., leaving £245,093 at credit of profit and loss account. In July last an interim dividend of 6 per cent. was paid, which absorbed £107,194, leaving £137,898 available. The directors recommended the payment of a further dividend of 6 per cent. on the shares of the company, carrying forward £23,237. The total number of passengers carried by the five companies could not be given in this year's report, owing to the Metropolitan District Railway being under Government control. During the year £64,494 was expended on the purchase of land and the construction and equipment of new garages. The Minister of Munitions had made an order declaring certain of the garages and factories of the company to be controlled establishments. The revenue account showed general receipts (including traffic receipts, private hire, advertising, and sundries) totalling £2,882,410. Included on the expenditure side were the following items :—Drivers' and conductors' wages, £705,208 ; road expenses (including licences, superintendence, ticket service, omnibus lighting, fuel, lubrication, compensation and law charges, garage expenses), £621,572 ; maintenance expenses (rolling stock, tires, £918,381, premises, furniture, and fixtures, £17,069), £935,450 ; general expenses, £149,911 ; depreciation, £23,747 ; contingencies and renewals, £175,000.

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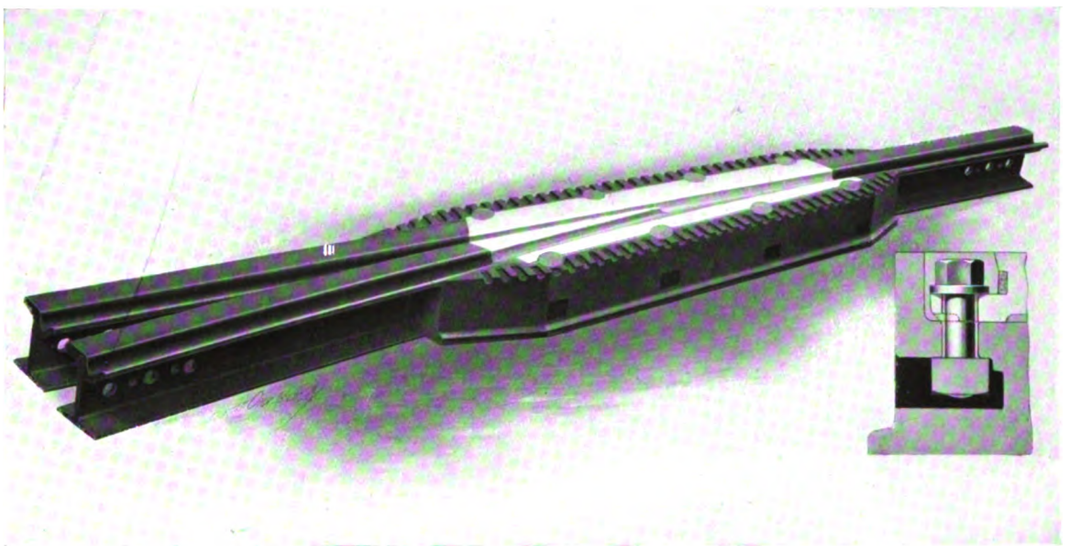

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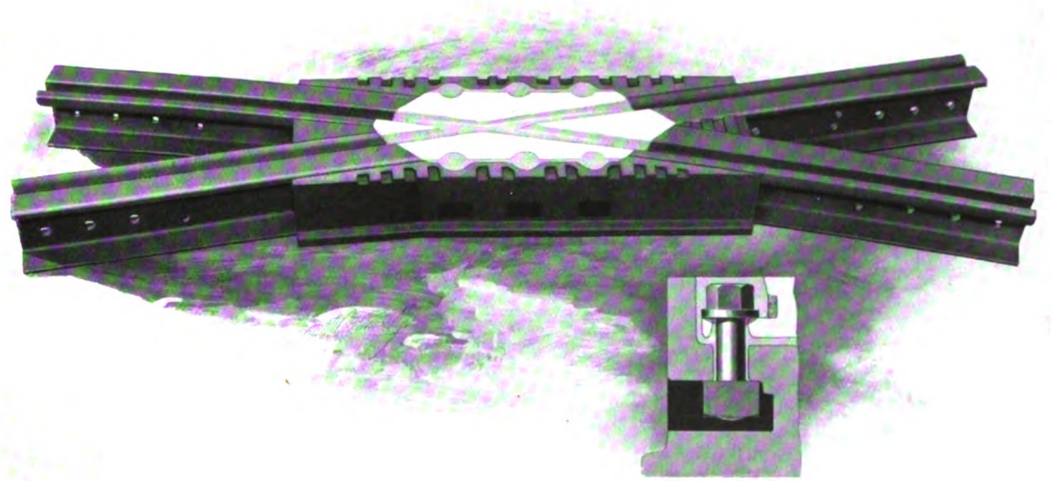

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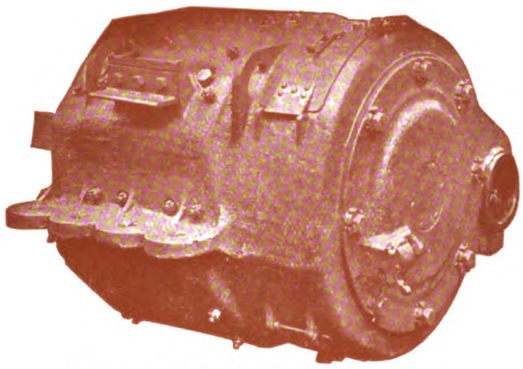
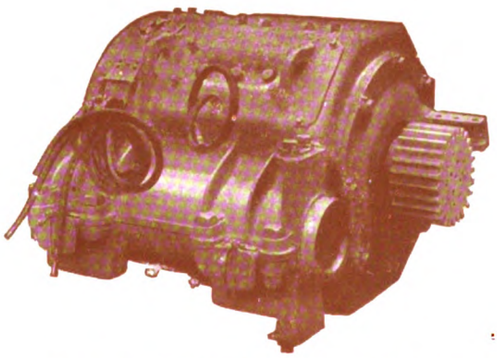
Railway Equipments



Dick, Kerr 250 B.H.P. Railway Motor, view from commutator end.



Dick, Kerr 250 B.H.P. Railway Motor, view from pinion end.

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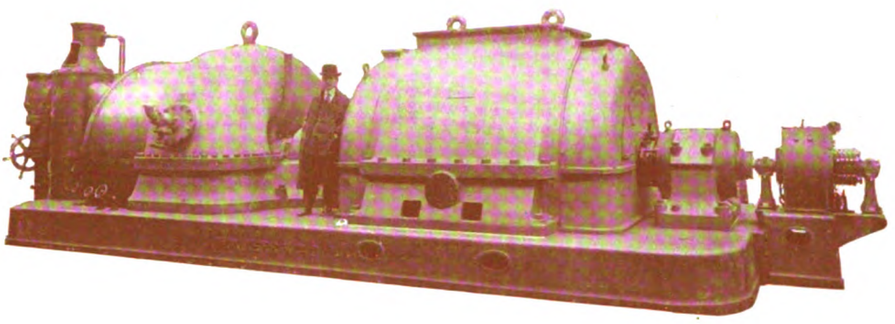

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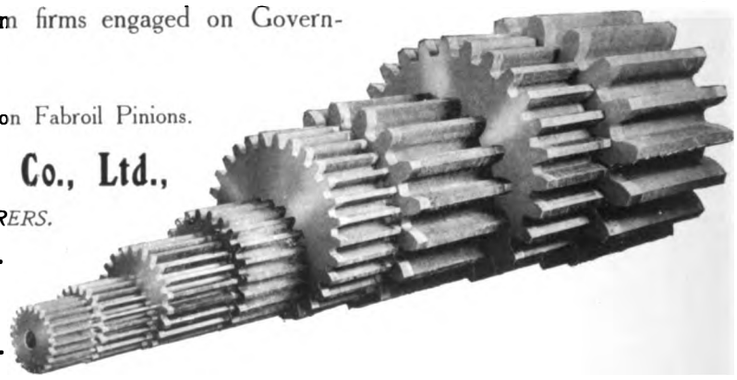

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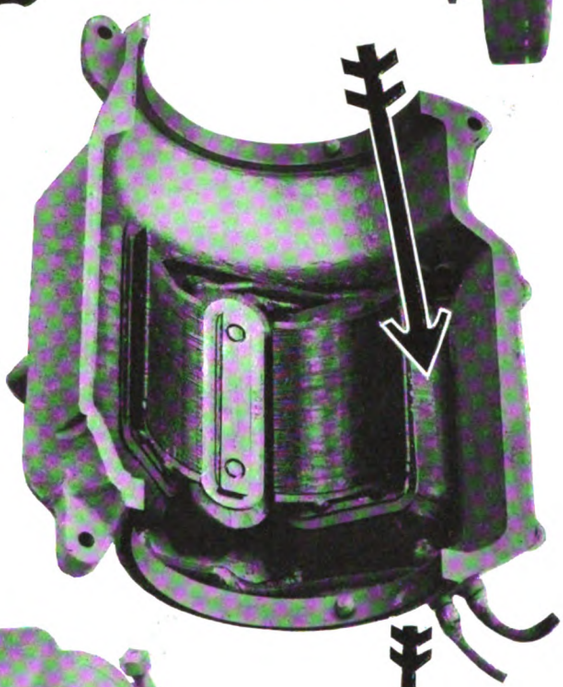

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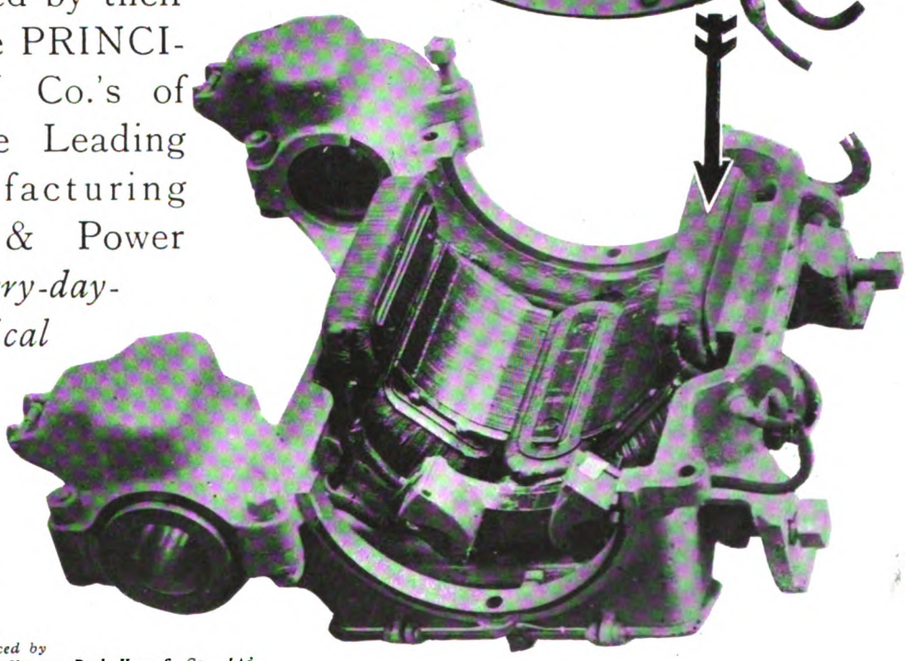

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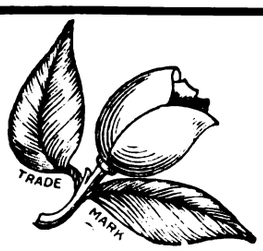

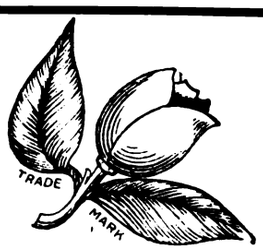

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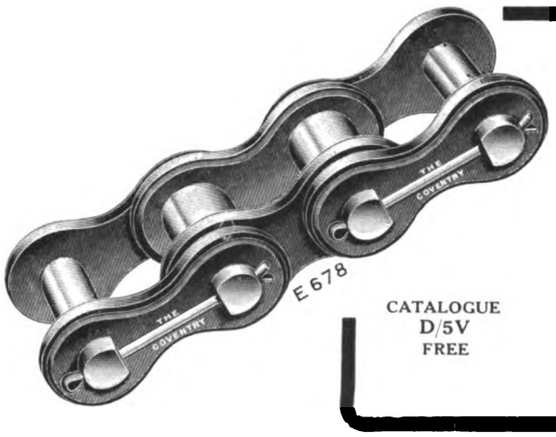

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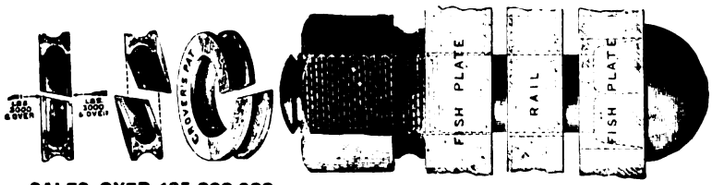

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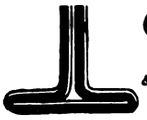

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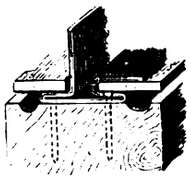

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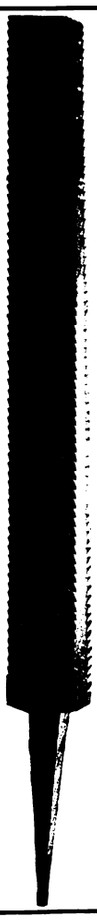

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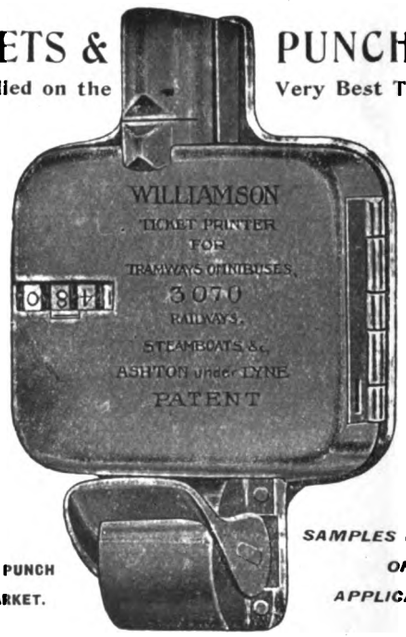

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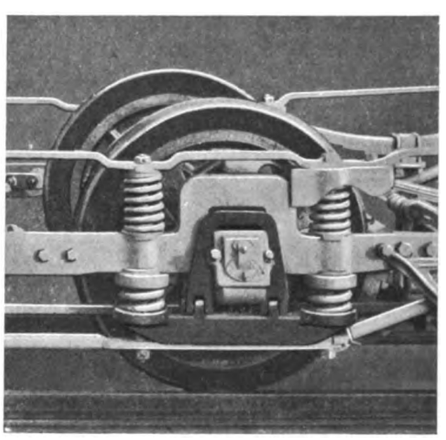

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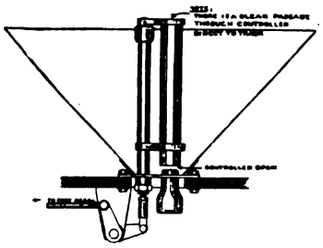

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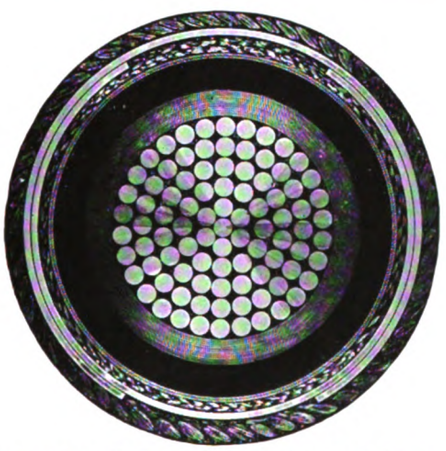

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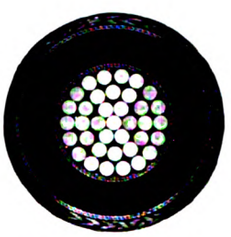

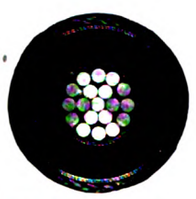

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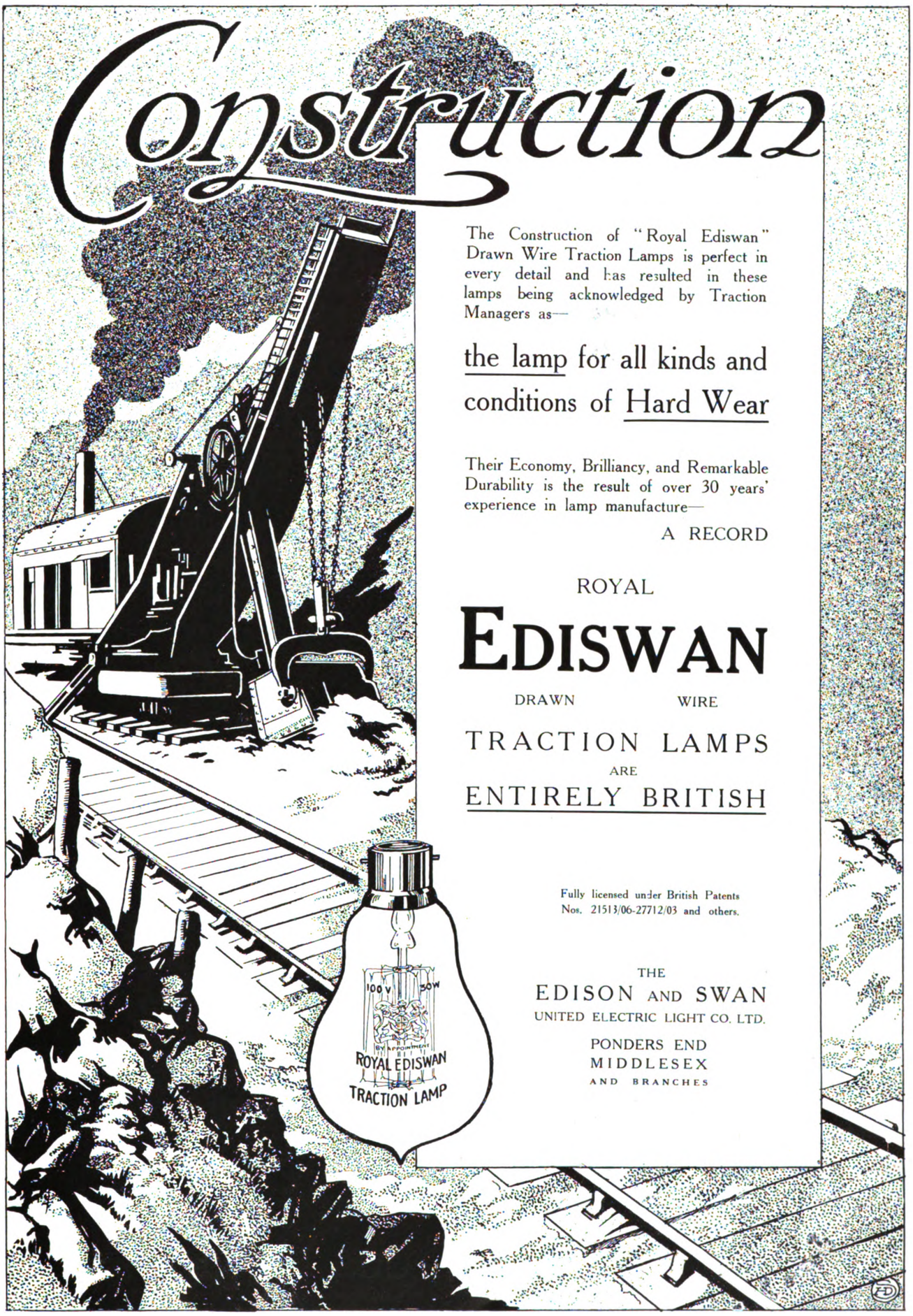

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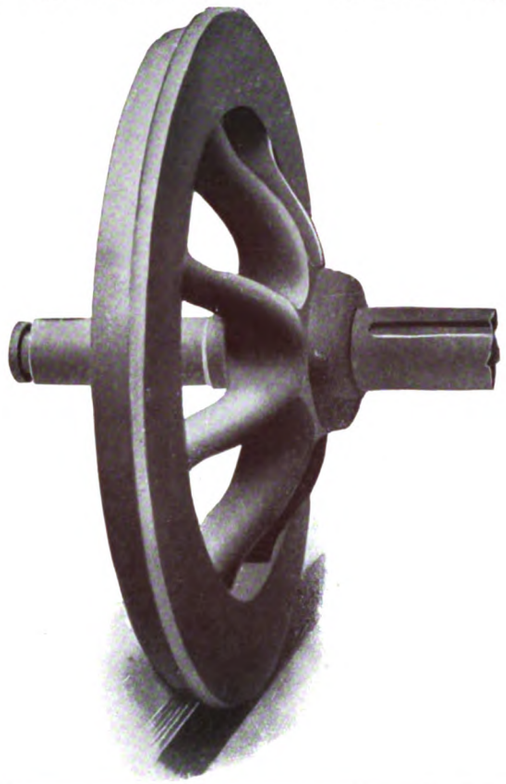

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POSTAL ADDRESS, TELEGRAPHIC ADDRESS, AND TELEPHONE NUMBERS.

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Aberdare Urban District Tramways, Gadlys Estate, Aberdare. [T.A., Tramways, Aberdare; T.N., 17.] *Gen. Manager and Elec. Engineer*, A. J. Abraham; *Traffic Supt.*, H. King; *Chairman Try. Com.*, Coun. E. Stonelake.

Aberdeen Corporation Tramways, Municipal Buildings, Union Street, Aberdeen. [T.A., Trams, Aberdeen; T.N. 826.] *Gen. Manager and Eng.*, R. S. Pilcher; *Per. Way Eng.*, J. Gordon; *Chairman Try. Com.*, Coun. Robertson.

Accrington Corporation Tramways, Market Hall, Accrington. [T.A., Trams, Accrington; T.N., 2212.] *Gen. Manager and Eng.*, H. Pilling; *Per. Way Eng.*, W. J. Newton; *Chairman Try. Com.*, Ald. T. E. Higham; *Vice-Chairman*, Coun. Morley.

Ashton-under-Lyne Corporation Tramways, Tramway Depot, Mossley Road, Ashton. [T.A., Tramways, Ashton; T.N., 325.] *Gen. Manager*, Ernest Holt; *Elec. Eng.*, N. Appelbee; *Chairman Try. Com.*, Ald. R. S. Oldham; *Vice-Chairman*, Ald. Waterhouse.

Ayr Corporation Tramways, Town Building, Ayr. [T.A., Trams, Ayr; T.N., 123.] *Gen. Manager and Eng.*, William Grant; *Burgh Elec. Eng.*, R. Marshall; *Per. Way Eng.*, John Young; *Rolling Stock Supt.*, Alf. Somerville; *Convener Try. Com.*, Coun. J. R. Learmont; *Vice-Chairman*, Bailie Murray.

Bacup Corporation Tramways.—Town Hall, Bacup, Lancs. [Lines leased to and worked by Rochdale Corporation.] *Town Clerk*, J. Entwistle; *Boro' Eng.*, W. H. Elce; *Chairman Try. Com.*, Ald. Sir H. Maden; *Vice-Chairman*, Coun. J. H. Lord (Mayor).

Barking Town Urban District Tramways, East Street, Barking. [T.N., 156 East Ham.] *Eng. and Manager*, W. Holmes; *Acting Engineer and Manager*, W. E. Kidner; *Chairman Try. Com.*, Coun. D. Gordon.

Barton-upon-Irwell District Council Light Railways, Barton-upon-Irwell.

[Line leased to and worked by the Lancashire United Tramways Co., *q.v.*]

Batley Corporation Tramways, Batley, Yorks. *Engineer*, S. D. Jones; *Chairman Try. Com.*, Coun. J. W. Turner; *Vice-Chairman*, Coun. F. W. H. Auty.

[Lines leased to and worked by the Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Belfast City Tramways, Tramways Office, Sandy Row, Belfast. [T.A., Nance, Tramway, Belfast; T.N., 2444.] *Gen. Manager*, Andrew Nance; *Traffic Manager*, R. McMaster; *City Elec. Eng.*, T. W. Bloxam; *Per. Way Eng.*, E. S. Pinkerton; *Chief Eng.*, A. A. Blackburn; *Chairman Try. Com.*, Coun. J. McCaughey; *Vice-Chairman*, Coun. J. Warwick.

Bexley Urban District Council Tramways, Car Sheds, Bexleyheath, Kent. [T.A., Stokes, Tramways, Bexleyheath; T.N., 79.] *Gen. Manager and Elec. Eng.*, H. P. Stokes; *Rolling Stock Supt.*, A. Williams; *Chairman Try. Com.*, Coun. E. T. Coote; *Vice-Chairman*, Coun. E. F. Reid.

Birkenhead Corporation Tramways, Laird Street, Birkenhead. [T.A., Tramways Manager, Birkenhead; T.N., 1110.] *Gen. Manager*, C. Clarke; *Borough Sur. and Eng.*, C. Brownridge; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Coun. H. Halsall; *Vice-Chairman*, Coun. R. Frame.

Birmingham Corporation Tramways, The Council House, Congreve Street, Birmingham. [T.A., Trams, Birmingham; T.N., Central 7,000.] *Gen. Manager*, A. Baker; *City Elec. Eng.*, R. A. Chattock; *Traffic Supt.*, J. McDonnell; *Per. Way Eng.*, C. E. S. Bill; *Rolling Stock Supt.*, R. H. Dickinson; *Chairman Try. Com.*, Coun. H. Barrow, J.P.; *Vice-Chairman*, Coun. A. G. Ellaway.

Blackburn Corporation Tramways, Tramways Office, Blackburn. [T.A., Tramways, Blackburn; T.N., 547.] *General Manager*, J. H. Cowell; *Elec. Eng.*, P. P. Wheelwright; *Traffic Manager*, E. Greek; *Car Shed Supt.*, H. W. Seymour; *Chairman Try. Com.*, Ald. W. Thompson; *Vice-Chairman*, Coun. C. Higham.

Blackpool Corporation Tramways, West Caroline Street, Blackpool. [T.N., 67.] *Gen. Manager*, C. Furness; *Traffic Supt.*, C. J. Baker; *Resident Eng.*, F. Field; *Chairman Try. Com.*, Ald. J. Brodie, J.P.; *Vice-Chairman*, Ald. R. Holt (Mayor).

Bolton Corporation Tramways, Bradshawgate, Bolton. [T.A., Manager, Tramways, Bolton; T.N., 490.] *General Manager*, J. Barnard; *Elec. Eng.*, W. J. H. Wood; *Per. Way Eng.*, E. Ll. Morgan; *Rolling Stock Supt.*, C. Beech; *Chairman Try. Com.*, Ald. J. Miles; *Vice-Chairman*, Coun. P. Higson.

Bootle Corporation Tramways, Electricity Works, Pine Grove, Bootle. [T.N., 424.] *Elec. Eng.*, T. D. Clothier; *Chairman Try. Com.*, Ald. Booth; *Vice-Chairman*, Coun. Pennington.

[Lines worked by Liverpool Corporation Tramways.]

Bournemouth Corporation Tramways, Tramways Offices, Lansdowne Crescent, Bournemouth [T.A., Tramways, Bournemouth; T.N., 1701.] *General Manager*, I. Bulfin; *Chief Assistant & Elec. Eng.*, H. Vickers; *Traffic Supt.*, R. O. Baldwin; *Chairman Try. Com.*, Coun. Bell; *Vice-Chairman*, Coun. McCabe.

Bradford Corporation Tramways, Central Office, 7, Hall Ings, Bradford. [T.A., Tramways, Bradford; T.N., 2381 and 2382.] *Gen. Manager*, C. J. Spencer; *Asst. Elec. Eng.*, J. W. Dawson; *Traffic Supt.*, T. Stirk; *City Elec. Eng.*, T. Roles; *Chairman Try. Com.*, Coun. Enoch Priestley; *Vice-Chairman*, Coun. J. Lund.

Brighton Corporation Tramways, Lewes Road, Brighton. [T.A., Tramways, Brighton; T.N., 353 P.O.] *Eng. & Manager*, William Marsh; *Traffic Supt.*, W. N. Brooks; *Rolling Stock Supt.*, W. Orchard; *Per. Way Eng.*, F. N. Hudson; *Chairman Try. Com.*, Coun. Martin.

Burnley Corporation Tramways, Queen's Gate, Burnley. [T.N., 46.] *Gen. Manager*, Henry Mozley; *Boro. Elec. Eng.*, J. E. Starkie; *Boro. Surveyor*, G. H. Pickles; *Chairman Try. Com.*, Coun. E. Heap; *Vice-Chairman*, Coun. Irving.

Burton-on-Trent Corporation Tramways, Guild Street, Burton-on-Trent. [T.N., 202.] *Manager*, A. B. Slater; *Engineer*, T. Hall; *Chairman Try. Com.*, Ald. J. S. Rowland (Mayor); *Vice-Chairman*, Ald. T. E. Lowe.

Bury Corporation Tramways, Market Place, Bury. [T.N., 26.] *Gen. Manager*, William Clough; *Boro. Elec. Eng.*, S. J. Watson; *Chairman Try. Com.*, Ald. T. S. Collinge; *Vice-Chairman*, Coun. Hargreaves.

Cardiff Corporation Tramways, Central Offices, The Hayes, Cardiff. [T.A., Tramways, Cardiff; T.N., 1211, 1240, 1350, and 377.] *Gen. Manager and Elec. Eng.*, A. Ellis; *Deputy Manager*, C. G. M. New; *Traffic Manager*, H. David; *Per. Way Eng.*, W. Harpur; *Rolling Stock Supt.*, Jas. Preston; *Chairman Try. Com.*, Ald. Sir J. W. Courtis, J.P.; *Vice-Chairman*, Coun. A. J. A. Stone.

Chester Corporation Tramways, Station Road, Chester. [T.N., 166.] *Traffic Supt.*, W. H. Ellis; *Elec. Eng.*, S. E. Britton; *Per. Way Eng.*, W. M. Jones; *Chairman Try. Com.*, Ald. J. Jones; *Vice-Chairman*, Coun. A. S. Dutton.

Chesterfield Corporation Tramways, Chatsworth Road, Chesterfield [T.A., Tramways, Chesterfield; T.N., 78.] *Gen. Manager and Elec. Eng.*, R. L. Acland; *Traffic Manager*, F. Root; *Per. Way Eng.*, C. E. Crossley; *Chairman Try. Com.*, Ald. E. Shentall (Mayor); *Vice-Chairman*, Coun. Woodhead.

Colchester Corporation Tramways, Magdalen Street, Colchester. [T.A., Tramways, Colchester; T.N., 92.] *Gen. Manager and Engineer*, R. C. Bullough; *Chairman Try. Com.*, Coun. A. M. Jarmin; *Vice-Chairman*, Coun. J. T. Bailey.

Colne Corporation Tramways, Colne, Lancashire. *General Manager and Engineer*, T. G. Richardson; *Chairman Try. Com.*, Coun. R. Knight (Mayor).

Coventry Corporation Tramways, Priestley's Bridge, Coventry. [T.A., Tramways, Coventry; T.N., 1014.] *Engineer and General Manager*, T. R. Whitehead; *Assistant Engineer*, W. M. Milnes; *Chairman*, Coun. C. V. Pugh; *Vice-Chairman*, Coun. H. W. Wale.

Croydon Corporation Tramways, Tramways Office, Thornton Heath, Surrey. [T.A., Tramways, Croydon; T.N., 406, Croydon.] *Tramways Manager*, T. B. Goodyer; *Chairman Try. Com.*, Ald. G. J. Allen; *Vice-Chairman*, Coun. A. A. Thomson.

Darlington Corporation Tramways, Haughton Road, Darlington. [T.A., Tramways, Darlington; T.N., 2435.] *General Manager and Elec. Eng.*, J. R. P. Lunn; *Traffic Supt.*, J. Fraser; *Chairman Try. Com.*, Ald. C. W. Starmer.

Dartford Urban District Council Tramways, Dartford. *Chairman Try. Com.*, Coun. R. Bennett; *Vice-Chairman*, Coun. J. B. Walton.

[Leased. See Dartford Tramways in list of Tramway Companies.]

Darwen Corporation Tramways, Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, F. J. S. Hosken; *Boro. Elec. Eng.*, C. H. Garnett; *Chairman Try. Com.*, Ald. Jas. Tomlinson.

Derby Corporation Tramways, 4, Victoria Street, Derby. [T.N., 410.] *Gen. Manager*, F. Harding; *Elec. Eng.*, T. P. Wilmshurst; *Per. Way Eng.*, J. Ward; *Chairman Try. Com.*, Coun. J. Dean.

Doncaster Corporation Tramways, Grey Friar's Road, Doncaster. [T.A., Rayner, Doncaster, T.N., 43.] *Manager & Elec. Eng.*, E. S. Rayner; *Chairman Try. Com.*, Coun. P. Stirling (Mayor); *Vice-Chairman*, Coun. Balmforth.

Dover Corporation Tramways, Town Hall, Dover. [T.A., Trams, Dover; T.N., 294.] *Gen. Manager*, E. Carden; *Per. Way Eng.*, W. C. Hawke (Boro. Surveyor); *Chairman Try. Com.*, Coun. Barwick; *Vice-Chairman*, Coun. Norman.

Dundee Corporation Tramways, Town House Buildings, Dundee. [T.N., 1340]; *Gen. Manager and Eng.*, Peter Fisher; *Elec. Eng.*, H. Richardson; *City Eng.*, J. Thomson; *Chairman Try. Com.*, Coun. G. A. Johnston.

East Ham (County Borough of) Corporation Tramways, Nelson Street, East Ham. [T.N., 611 and 100, East Ham.] *Gen. Manager and Elec. Eng.*, W. C. Ullmann; *Chairman Try. Com.*, Ald. M. Oakes.

Eccles Corporation Tramways, Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Ald. W. J. Nuttall, J.P.; *Vice-Chairman*, Coun. Alexander.

[Lines worked by Salford Corporation.]

Erith Urban District Council Tramways, Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, J. C. Williams; *Chairman Try. Com.*, Coun. G. C. Humphreys.

Exeter Corporation Tramways, Paris Street, Exeter. *Manager*, H. C. Bartlett; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, Ald. H. B. Varwell; *Vice-Chairman*, Coun. F. G. Towill.

Farnworth Urban District Council Tramways, Albert Road, Farnworth. *Chairman Try. Com.*, Coun. S. C. Steele; *Vice-Chairman*, Coun. Stanley.

[Lines leased to the South Lancashire Tramways Co.]

Glasgow Corporation Tramways, 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., 1040, Douglas.] *Gen. Manager*, J. Dalrymple; *Traffic Supt.*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Elec. Eng.*, E. T. Goslin; *Sec.*, J. N. Wilson; *Chairman Try. Com.*, Coun. Montgomery; *Vice-Chairman*, Bailie Kelly.

Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts; *Vice-Chairman*, Coun. C. J. Ramstedt.

Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant; *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Coun. J. T. C. Salmon.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 36 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A. Fawcett.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager and Elec. Eng.*, Barnes Kay; *Per. Way Eng.*, J. S. Green (Borough Surveyor); *Chairman Try. Com.*, Coun. Waddington; *Vice-Chairman*, Coun. Haworth.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Eng. and Manager*, H. C. Dufton.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 47.] *Gen. Manager*, R. B. Leach; *Per. Way Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Coun. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

Huddersfield Corporation Tramways, Northumberland Street, Huddersfield. [T.N., 698 and 898.] *Gen. Manager & Elec. Eng.*, R. H. Wilkinson; *Assist. Engineer*, A. P. Quilliam; *Traffic Supt.*, T. Hartley; *Borough Eng.*, K. F. Campbell; *Chairman Try. Com.*, Coun. E. H. Sellers; *Vice-Chairman*, Coun. T. Canby.

Hull Corporation Tramways, Alfred Gelder Street, Hull. [T.N., 444, Corporation.] *Manager*, Wm. J. McCombe; *Elec. Eng.*, J. Wilkinson; *Per. Way Eng.*, F. W. Bricknell (*City Engineer*); *Chairman Try. Com.*, Ald. J. H. Hargreaves (Lord Mayor); *Vice-Chairman*, Coun. W. Wheatley.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager and Engineer*, L. E. Harvey; *Chairman Try. Com.*, Coun. W. J. T. Cullis; *Vice-Chairman*, Coun. Owen Waters.

Ilkeston Corporation Tramways, Park Road Ilkeston. [T.A., Bellamy Ilkeston; T.N., 26.] *Manager and Elec. Eng.*, L. C. F. Bellamy; *Acting Engineer and Manager*, G. H. Browne; *Chairman Try. Com.*, Coun. J. E. Bestwick; *Vice-Chairman*, Coun. Kane.

Ipswich Corporation Tramways, Constantine Road, Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome; *Vice-Chairman*, W. P. Burton.

Kearsley Urban District Council Tramways, Council Office. Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.

[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, South Street, Keighley. [T.A., Tramways, Keighley; T.N., 17.] *Gen. Manager and Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. A. Smith.

Kilmarnock Corporation Tramways Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, W. C. Bexon; *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com.*, Bailie Jones.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Kirkcaldy Corporation Tramways, Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson.

Leeds City Tramways, Swinegate, Leeds. [T.A., Tramways, Leeds; T.N., 44 and 169; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Per. Way Eng.*, R. B. Holt; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Boro. Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Judge Hall.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. J. A. Hennah.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Stanley Clegg, Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White; *Vice-Chairman*, Coun. M. A. Ashley.

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, C. W. Mallins; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *City Electrical Engineer*, Harold Dickinson; *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Coun. E. Russell Taylor; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 62, Finsbury Pavement, London, E.C. [T.A., Lotram Ave., London; T.N., 3321, 3322, and 3323 London Wall.] *Chief Officer*, A. L. C. Fell; *Deputy Chief Officer*, J. K. Bruce; *Traffic Assist.*, L. Slattery; *Rolling Stock Supt.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, G. H. Hume; *Vice-Chairman*, T. Prestige.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett.

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Coun. D. T. J Lyle; *Vice-Chairman*, Coun. Green.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Coun. F. Goodyear.

Middleton Corporation Tramways. *Consulting Engs.*, Lacey, Sillar, and Leigh; *Chairman Try. Com.*, Ald. W. Wood, J.P. (Mayor); *Vice-Chairman*, Ald. Bentley, J.P.
[Worked by Manchester Corporation Tramways.]

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. R. Mayne; *Vice-Chairman*, Coun. A. M. Sutherland.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 990 L., Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Per. Way Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways, St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis; *Vice-Chairman*, Coun. W. Beale.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain, J.P.; *Vice-Chairman*, Ald. F. R. Radford, J.P.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, ————; *Traffic Supt.*, J. Brierley; *Chairman Try. Com.*, Ald. F. G. Isherwood; *Vice-Chairman*, Coun. F. Elliot.

Perth Corporation Tramways, 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Calderwood.

Plymouth Corporation Tramways, 15, Ebrington Street, Plymouth. [T.N. 518, Plymouth.] *General Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. S. H. Phillips, J.P.; *Vice-Chairman*, Coun. J. Moon.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Inspector*, W. May; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 110 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson; *Vice-Chairman*, Ald. R. Payne.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Traffic Supt.*, C. H. Manning; *Chairman, Try. Com.*, Ald. J. Ormrod; *Vice-Chairman*, Coun. T. Parkinson.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Walker Allen, J.P.
[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81 and 85.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. J. W. Stansfield.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P. (Deputy Mayor).

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, S. S. Platt; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. Taylor.

Rotherham Corporation Tramways, Rawmarsh Road, Rotherham. [T.A., Cross, Rotherham; T.N., 138, 152, and 241.] *General Manager & Elec. Eng.*, E. Cross; *Deputy Elec. Eng.*, J. R. Lilleker; *Traffic Superintendent*, H. Jagger; *Per. Way Eng.*, T. P. Collinge; *Rolling Stock Supt.*, C. A. Walker; *Chairman Try. Com.*, Ald. D. L. Winter; *Vice-Chairman*, Coun. T. Reeves.

St. Helens Corporation Tramways, Town Hall, St. Helens, Lancs. *Chairman Try. Com.*, Ald. Sir J. Beecham; *Vice-Chairman*, Coun W. N. Pilkington.
[Lines worked by the New St. Helens and District Tramways Co.]

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, J. A. Robertson; *Traffic Supt.*, J. W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. W. H. Barrett.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Traffic Supt.*, A. Handford; *Per. Way Eng.*, W. J Haddield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. Com.*, Ald. Sir W. Clegg, J.P.; *Vice-Chairman*, Coun. A. T. Bescoby, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, Wm Redman; *Chairman Try. Com.*, H Pitts.
[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, W. T. Robson; *Boro. Elec. Engineer*, H. F. Street; *Traffic Manager*, C. G. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. Daniells,; *Per. Way Eng.*, E. J. Elford (*Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Ald. A. Martin.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Piermaster*, Capt. N. E. Hucker; *Chairman*, Coun. H. Dowsett.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Ald. Griffiths, J.P.; *Vice-Chairman*, Coun. Clayton.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, H. S. Ellis; *Chairman Try. Com.*, Ald. W. G. Wylie; *Vice-Chairman*, Ald. J. W. Henderson.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Coun. S. C. Homer.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Ald. Chas. Sharples; *Vice-Chairman*, Ald. W. E. Hamnett.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Chairman Try. Com.*, Coun. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker, J.P.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *Manager*, T. Medcalf; *Elec. Eng.*, A. Dimmack; *Consulting Engs.*, Lacey, Sillar, & Leigh; *Chairman Try. Com.*, Coun. A. D. Richards; *Vice-Chairman*, Coun. A. Bull.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1431, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

Walsall Corporation Tramway, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. Clarke; *Vice-Chairman*, Coun. R. J. Bishop.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 190] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Coun. Dr. G. W. Joseph; *Vice-Chairman*, Coun. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Try. Com.*, Ald. A. G. Turley, J.P. (Mayor); *Vice-Chairman*, Coun. G. Garratt.
[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 868 East.] *General Manager*, J. S. D. Moffet; *Boro' Elec. Eng.*, J. W. Beauchamp; *Chairman Try. Com.*, Ald. H. W. Littler.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Charlton.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *Gen. Manager*, F. Buckley; *Per. Way Eng.*, A. T. Gooseman; *Chairman Try. Com.*, Ald. R. T. Fletcher; *Vice-Chairman*, Coun. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. W. H. Sessions.

COMPANY TRAMWAYS.

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, W. Jackson, Dr. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles, G. J. Somerville.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *Acting Manager*, W. E. Nicoll; *Acting Sec.*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Barrow; T.N., 125.] *Manager*, W. F. Bladon; *Sec.*, F. J. Cursons; *Acting Sec.*, J. S. Bowker; *Chairman*, H. S. Day; *Directors*, J. V. Kitchener, E. R. Soames.

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, Hon. Sir J. Sivewright, K.C.M.G.; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton, E. Callaird.

Bessbrook and Newry Tramway Company, Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, Robert Caven; *Elec. Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, T. McGreggor Greer.

Birmingham District Power and Traction Company, Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone, R. J. Howley.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Blackpool and Fleetwood Tramroad Company, Ltd., Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 121.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, John Greenwood; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington, G. Richardson, G. Readman.

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Blackpool, St. Anne's, and Lytham Tramways Company, Ltd., Squires Gate, and 30, Birley Street, Blackpool. [T.N., 327 and 22]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, G. Nicholson; *Directors*, T. M. Smith, T. Preston.

Bray and Enniskerry Railway Company, 52, Westland Row, Dublin. *Sec.*, M. F. Keogh; *Chairman*, A. Killingley; *Director*, F. M'Crea.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, Magnus Volk; *Traffic Superintendent*, H. Sheppard; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Chas. Challenger; *Assist. Manager*, S. E. Smith; *Electrical Engineer*, W. H. Munton; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, Sir G. White, Bart.; *Directors*, W. G. Verdon Smith (*Managing*), S. White, J.P., J. H. Howell, J.P., G. Stanley White.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. E. Garcke (*chairman*); *Directors*, C. Shirreff B. Hilton, W. L. Madgen, A. Shepherd, G. T. Symons, C. G. Tegetmeier, P. D. Tuckett; *Joint Managers*, C. H. Dade and R. J. Howley; *Acting Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.	Merthyr.
Barnsley & District.	Middleton.
Barrow-in-Furness.	Oldham, Ashton, & Hyde.
Birmingham & District Power & Traction Co.	Peterborough.
Birmingham & Midland	Potteries.
Dudley, Stourbridge, & District.	Rotherham.
South Staffordshire.	Sheerness & District.
Wolverhampton Dist.	South Metropolitan.
Devonport & District.	Southport.
Gateshead & District.	Swansea.
General Elec. Tramways.	Taunton.
Gravesend & Northfleet.	Tynemouth & District.
Greenock & Port Glasgow.	Weston-super-Mare & District.
Jarrow & District.	Worcester.
Kidderminster & District.	Wrexham & District.
	Yorkshire (Woollen Dist.)

Burton and Ashby Light Railways, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, A. L. Charles; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Douglas Owen.

Carlisle Tramways Company, Ltd., City of. Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, R. L. McCulloch.

Chatham and District Light Railways Company, Luton Road, Chatham, and 83, Cannon Street, London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Traffic Manager*, W. G. Davies; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Directors*, A. H. Beatty (*Chairman*), W. Shearer, H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C. A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, St. George's Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, Capt. W. Martindale, H. C. Levis.

Dartford Urban District Council Light Railways. Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Balfour, Beatty, & Co., Ltd., 66, Queen Street, London, E.C.) *Acting Manager*, F. A. Kincaid Fergusson.

Devonport and District Tramways Company, Electrical Federation Offices, London, W.C. [T.A., Head Office, Devonport c/o Tramway, London; T.N., Head Office, Holborn 2686. *Manager and Eng.*, George Cardwell; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier, R. J. Sutcliffe.

[The Company's undertaking has been sold to Plymouth Corporation.]

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways. (Lessees: The National Elec. Construction Co., Ltd., 3, Laurence Pountney Hill, London, E.C.) [T.A., Overhauled, London; T.N., 5329 and 5330 Bank.] *Manager*, W. MacGibbon.

Douglas—Ramsey. (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282 and 4006 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, A. B. Coyle, J.P.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. Marshall Harriss; *Elec. Eng.*, R. Tanham; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, W. M. Murphy, J.P.; *Directors*, W. F. Cotton, J.P., J. Mooney, Rt. Hon. L. A. Waldron, P.C.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley.

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 23, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, J. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager & Engineer*, Daniel Fisher; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A., Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Secretary*, H. W. Davis; *Chairman*, H. S. Day; *Directors*, H. A. Stagg, C. R. Greene, Judge L. A. Atherley-Jones, K.C.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, F. J. S. Moore; *Directors*, C. M'D. Stuart, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, A. W. Bullough; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 958, Gravesend.] *Manager*, J. R. Groves; *Sec.*, H. C. Walter; *Chairman*, W. L. Madgen; *Directors*, P. N. Gray, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Bianco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A. Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, E. Valied, J. B. Collings, Q. Le Pelley.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. Vincent Edwards; *Secretary*, W. R. Elston; *Cons. Engs.*, Kincaid, Waller, Manville, and Dawsen; *Chairman*, G. Kitchen; *Directors*, E. C. Morgan, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, W. G. Verdon Smith; *Manager*, F. Freshwater; *Chairman*, Sir George White, Bart.; *Directors*, H. C. Godfray, J. H. Howell, S. White.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, ——————; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, W. M. Murphy, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *General Manager*, W. G. Bond, *Secretary*, B. Kingsford; *Chairman*, E. Garcke; *Directors*, J. A. Lycett, H. S. Day, W. L. Madgen.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager and Engineer*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. A. Stanley, M.P.; *Directors*, J. M. Henderson, M.P., Sir J. Beecham, J.P., R. Watson, J.P., A. Adam, J. S. Austen.

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, W. H. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey J. U. Hodgson, M. H. Maxwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

Llanelly and District Electric Lighting and Traction Company, Ltd., Llanelly, and 66, Queen Street, London, E.C. *Engineer and Manager*, J. E. Stewart; *Secretary*, G. D. Prince; *Chairman*, A. R. Holland; *Directors*, A. V. Anderson, M. A. Edwards, A. H. Beatty.

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *Gen. Manager and Eng.*, A. H. Pott; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, Sir A. H. Stanley, F. V. Schuster.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, A. E. Wray.

Mansfield & District Light Railway Co., Sutton Road, Mansfield. [T.A., Cars, Mansfield; T.N., 107.] *Gen. Manager and Sec.*, Stanley Dudman, *Chairman*, A. R. Holland; *Directors*, W. J. Chadburn, A. H. Beatty, G. Balfour.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Manx Electric Railway Company, Ltd., 1, Strathalian Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, C. A. Hunt; *Chairman*, Col. Sir A. Griffith Boscawen; *Directors*, Sir W. H. Vaudrey, B. E. Greenwell, E. Remnant.

Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Secretary*, S. J. Clements; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

Metropolitan Electric Tramways, Limited, Electric Railway House, Broadway, Westminster, London, S.W. [T.A., Metrolito, London; T.N., 6800, Victoria.] Manor House Offices, Seven Sisters Road, N. [T.A., Lentiscus, London; T.N., 77 Tottenham.] *Gen. Manager and Eng.*, A. H. Pott; *Traffic Manager*, W. E. Hammond; *Secretary*, A. L. Barber; *Chairman*, E. Garcke; *Directors*, Sir E. Spencer, W. L. Madgen, C. G. Tegetmeier, J. Devonshire (*Managing Director*).

Mexborough and Swinton Tramways Company, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 3, Laurence Pountney Hill, Cannon Street, London, E.C. *Manager and Eng.*, P. Priestly; *Cons. Elec. Eng.*, F. E. Stanley; *Commercial Manager*, Wm. T. Mitchell; *Traffic Supt.*, M. McLeod; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Director* (*Managing*), W. B. Cownie, C.A.

Middlesbro, Stockton, and Thornaby Electric Tramway, Bridge Road, Stockton-on-Tees, and Clare Street House, Bristol. [T.A., Tramways, Stockton; T.N., 129.] *Manager*, F. Freshwater; *Secretary*, W. G. Verdon Smith; *Chairman*, Sir Geo. White Bart.; *Directors*, H. C. Godfray, S. White, H. C. Doggett

Middleton Electric Traction Company, Ltd., Hiltonfold Lane, Middleton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depot, Middleton; T.N., 37 Middleton.] *Gen. Manager*, W. F Endean; *Secretary*, G. R. Oliphant; *Acting Secretary*, J. S. Bowker; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreatha l.

Morecambe Tramways Company, Heysham Road, Morecambe, and 62, Market Street, Lancaster. [T.N 1. Morecambe. and 71. Lancaster.] *Secretary and Manager*, G. H. Petty; *Chairman*, W. H. Pickles; *Directors*, J. Stott, S. Wright, O. Carr.

Musselburgh and District Electric Light and Traction Co., Ltd., High St., Musselburgh, N.B. [T.A., Tramways, Musselburgh; T.N., 115.] (Registered Office, 3, Laurence Pountney Hill, London, E.C. [T.N., 5329 and 5330, Bank]) *Manager*, R. Watson; *Resident Engineer*, E. J. Walsh; *Traffic Inspector*, W. Mittell; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, B. Burnham, J. Anderson, W. B. Cownie, R Watson.

New General Traction Company, Ltd., 8, Crosby Square, London, E.C. *Managing Director*, E. A. Hopkins; *Secretary*, J. G. Mills; *Chief Engineer*, I. E. Winslow: *Chairman*, Baron E. B. d'Erlanger. [This company controls the Norwich and the Douglas Southern Electric Tramways Companies.]

New St. Helens and District Tramways Company, Ltd., Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 86 Atherton.] *Engineer and Manager*, C. D. Stanley; *Secretary*, H. P. Conibear; *Chairman*, Hon. Arthur Stanley, M.P.; *Directors*, J. Hunter, J.P., H. Martin, J.P., J. M. Henderson, M.P., J. S. Austen, and E. H. Edwardes (*Managing*).

North Shields Tramway Company owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

Norwich Electric Tramway Company, 5, Orford Hill, Norwich, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, F. W. Ketley; *Consulting Eng.*, I. E. Winslow; *Sec.*, J. G. Mills; *Directors*, E. A. Hopkins, Hon. A. G. Brand, F. FitzGerald, G. M. Chamberlin, and C. Pakeman.

Nottinghamshire and Derbyshire Tramways Company, Tramway Depot, Langley Mill, Derbyshire, and 66, Queen Street, London, E.C. [T.A., Tramways, Langley Mill; T.N., 53, Langley Mill.] *Manager*, C. R. Walker; *Secretary*, Wm. C. Bryden; *Directors*, A. R. Holland, A. H. Beatty, A. V. Anderson, and M. A. Edwards.

Oldham, Ashton and Hyde Electric Tramway, Ltd., Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Denton; T.N., 265 Ashton.] *Supt.*, A. Anderson; *Secretary*, F. J. Cursons; *Acting Secretary*, J. S. Bowker; *Chairman*, E. Garcke; *Directors*, Judge L. A. Atherley Jones, K.C., W. S. Wreathall, J. V. Kitchener (*Managing Director.*)

Paisley District Tramways Company, Tramway Depôt, Paisley, and 83, Cannon Street, London, E.C. [T.N., 218 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Lord Arthur Butler, D. Johnston Smith, John Young.

Peterborough Electric Traction Company, Ltd., Lincoln Road, Peterborough, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Peterborough; T.N., 224.] *Gen. Manager*, T. G. Clubburn; *Secretary*, S. M Wright; *Acting Sec.*, P. N. Gray; *Chairman*, Lord Vaux of Harrowden; *Directors*, E. A. Paris, R. J. Howley.

Plymouth, Stonehouse and Devonport Tramways Co., 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. [T.N. 53.] *Manager*, G. H. Moreton; *Elec. Eng.*, J. Graham Pearce; *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*).

Portsdown and Horndean Light Railway, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Engineer and Manager*, J. Fereday Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern.

Potteries Electric Traction Company, Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Stoke-on-Trent; T.N., 141.] *Gen. Manager and Eng.*, W. Thom; *Power and Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, B. Kingsford; *Chairman*, R. J. Howley; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

Rhondda Tramways Company, Ltd., Tramway Depot. Porth, Rhondda, and Laurence Pountney Hill, Cannon Street, London, E.C. [T.A., Tramways, Porth; T.N., 118.] *Manager and Engineer*, H. Holliday; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, H. T. Barnett.

Rothesay Tramways Company, Ltd., Point House, Rothesay, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, A. C. Miles; *Directors*, W. L. Madgen, H. S. Day.

Ryde Pier Company, Ryde, Isle of Wight. *Manager*, W. D. Stanney; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

Scarborough Tramways Company, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, J. V. Moinet; *Chairman*, F. E. Gripper; *Directors*, V. Fowler, M. T. Whittaker, J. C. Wigham.

Sheerness and District Electric Power and Traction Company, Ltd., Electricity Works, Sheerness East, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Sheerness; T.N., 45.] *Manager & Eng.*, A. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, R. J. Howley, E. R. Soames.

Snaefell Mountain Railway (See Manx Electric Railway Company).

South Metropolitan Electric Tramways and Lighting Company, Ltd., 114, Church Street, Croydon, 30, High Street, Sutton, and Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 304 Croydon, 14 Sutton and 6800, Victoria.] *Gen. Manager and Engineer*, A. V. Mason; *Secretary*, W. M. Wright; *Chairman*, C. G. Tegetmeier; *Directors*, J. Devonshire (*managing*), E. Garcke, A. L. Barber.

Southport Pier Co., Ltd., Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, A. T. Faiers; *Chairman*, A. Skinner; *Directors*, J. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

Southport Tramways Company, Ltd., The Depôt, Churchtown, Southport, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, J. Lloyd; *Secretary*, H. A. Stagg; *Chairman*, C. S. Hilton; *Directors*, J. S. Haworth, Lord Vaux of Harrowden, J. V. Kitchener, G. R. Hulme.

South Staffordshire Tramways (Lessee) Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, W. S. Schuster; *Directors*, J. A. Lycett, S. R. Blundstone, R. J. Howley, B. Kingsford.

Sunderland District Electric Tramways, Ltd., Fence Houses, co. Durham. [T.A., Trams, Philadelphia, Shiney Row; T.N., 21, Houghton-le-Spring.] *Resident Manager and Engineer*, G. Stratton; *Traffic Manager*, E. A. Pearman; *Secretary*, H. J. Almond; *Directors*, H. R. Hogg, Hon. R. Parker, R. Tayler, A. Counter, C. Eves.

Sutton and Howth Electric Tramway Company (owned by the Great Northern Railway, Ireland), Sutton, county Dublin, and Amiens Street Station, Dublin. [T.A., Railroad, Dublin; T.N., 171, Dublin, and 16 Sutton.] *Gen. Manager*, John Bagwell; *Elec. Eng.*, A. W. Whieldon; *Chief Eng.* F. A. Campion; *Locomotive Eng.*, G. T. Glover; *Sec.*, T. Morrison; *Chairman*, F. Vernon; *Directors*, W. P. Cairnes (*Deputy Chairman*), W. B. Carson, H. S. Guinness, J. T. Reade, Capt. W. L. A. Goulding, Lt.-Col. J. C. W. Madden, R. A. Gradwell, J. Milne Barbour, T. F. Cooke, W. H. B. Moorhead, Lt.-Col. H. Plews, G. S. Clark.

Swansea Improvements and Tramways Company, 2, Rutland St., Swansea, and Electrical Federation Offices. Kingsway, London, W.C. [T.A., Tramway, Swansea; T.N., 268 Swansea.] *Gen. Manager*, D. James; *Elec. Eng.*, A. Johnston; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, G. J. Somerville, S. E. Garcke, E. R. Soames.

Taunton Electric Traction Company, Ltd., East Reach, Taunton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Taunton, c/o "Tramways," London.] *Manager*, B. H. Griffith; *Acting Manager*, L. Marshall; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, G. J. Somerville; *Directors*, E. Garcke.

Torquay Tramways Co., Ltd., St. Marychurch Road, Torquay. [T.A., Carsheds, Torquay; T.N., 167 Torquay.] *Registered Office*, 3, Laurence Pountney Hill, Cannon Street, E.C. *Manager and Eng.*, H. J. Nisbett; *Secretary*, L. D. H. Jacobs; *Managing Director*, W. B. Cownie.

Trafford Park Company (Tramways), Trafford Park, Manchester. [T.A., Developing, Manchester; T.N., 61, Trafford Park.] *Secretary*, C. A. Grundy; *Chairman*, Marshall Stevens; *Directors*, Sir J. Lyons, H. McNiel.

[Lines worked by the Manchester and Salford Corporations.]

Tynemouth and District Electric Traction Company, Limited, John Street, Cullercoats, Northumberland, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tram Co., Cullercoats; T.N., 17 Whitley.] *Gen. Manager*, H. J. Smith; *Sec.*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. H. Robinson, J. B. Williamson, R. J. Howley, Geo. J. Somerville.

Tyneside Tramways and Tramroad Company, Ltd., Neptune Bank, Wallsend. [T.A., Tramways, Wallsend; T.N., 84.] *Secretary & Res. Manager*, J. C. Little; *Elec. Eng.*, F. H. Briggs; *Cons. Eng.*, W. McLellan; *Chairman*, J. T. Merz; *Directors*, Lord Armstrong, J. H. Armstrong, G. E. Henderson, S. Hunter.

Wakefield and District Light Railway Company, Belle Isle, Wakefield.

[This company has been amalgamated with the Yorkshire (West Riding) Electric Tramways Co., Ltd.]

Walton-on-the-Naze Pier Tramway (Coast Development Corporation, Ltd.), The Pier, Walton-on-the-Naze. [T.A., Electricity Works, Walton-on-Naze.] *Eng.*, E. A. Lambert, A.M.I.E.E.

Wemyss and District Tramways Company, Ltd., Car Depot. Aberhill, Methill, N.B. [T.A., Tramways, Methill; T.N., 38 Leven.] *Gen. Manager*, W. T. Dawson; *Sec.*, J. O. Shepherd; *Chairman*, G. Balfour; *Directors*, W. Shepherd, G. Balfour, J. H. Guild.

Weston-super-Mare and District Electric Supply Co., Ltd., Locking Road, Weston-super-Mare, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Weston-s.-Mare; T.N., 79 & 181.] *Manager and Elec. Eng.*, G. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, E. R. Soames.

Wolverhampton District Electric Tramways, Limited, Tramway Depot, Bilston, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Bilston; T.N., 56, Bilston.] *General Manager*, W. G. Bond; *Sec.*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley, B. Kingsford.

Worcester Electric Traction Company, Ltd., St. John's Worcester, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Worcester; T.N., 81.] *Engineering Manager*, R. Simpson; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. A. Lycett, B. Kingsford, W. S. Wreathall.

Wrexham and District Transport Co., Ltd., 6, Lord Street, Wrexham, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Wrexham; T.N., 182, Wrexham.] *Manager*, A. A. Hawkins; *Sec.*, J. R. Oliphant; *Acting Sec.*, J. S. Bowker; *Chairman*, J. V. Kitchener; *Directors*, G. J. Somerville, W. S. Wreathall.

Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. [T.A., England, Belle Isle, Wakefield; T.N., 213.] *Gen. Manager and Sec.*, H. England; *Elec. Engs.*, C. J. Jewell and E. A. Wood; *Traffic Supt.*, W. J. McDonald; *Chairman*, Sir Herbert S. Leon, Bart.; *Directors*, B. Newgass, G. E. Leon, E. Remnant, W. Murray.

Yorkshire (Woollen District) Electric Tramways, Limited, Frost Hill, Liversedge, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Heckmondwike; T.N., 8 Heckmondwike.] *Secretary*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Sir Thos. Pilkington, E. A. Paris (*managing*).

TRAMWAY ASSOCIATIONS.

MUNICIPAL TRAMWAYS ASSOCIATION.

President:
PETER FISHER
(General Manager, Dundee Corporation Tramways).

Vice-President:
HENRY MOZLEY
(General Manager, Burnley Corporation Tramways).

Hon. Secretary and Treasurer:
C. J. SPENCER
(General Manager, Bradford Corporation Tramways), 7, Hall Ings, Bradford.

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President:
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Chairman:
The Hon. ARTHUR STANLEY, M.P.

Vice-Chairman:
HARRY ENGLAND.

Hon. Solicitor: W. MORRIS, Junr. *Hon. Auditor:* A. W. CHAMBERS, A.S.A.A.

Secretary:
A. DE TURCKHEIM.

Offices: Caxton House, Westminster, London, S.W. Telephone No. 2110 Victoria.

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LIST OF ELECTRIC TRAMWAYS & RAILWAYS.

PARTICULARS OF TRACK AND EQUIPMENT.

TRAMWAYS, pp. xxvii-xxx. RAILWAYS, p. xxx.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No of Motor Cars.	No of Dynamos	No. of Engines	Type of Engines	Total Capacity Traction, Kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS.				ft. in.	lbs.	1 in	ft. rad.						
Aberdare Urban District Trys. ..	Oct., 1913	2·9	3·3	3 6	96 G	13	45	14	2	2	V. Cp. C.	400	Lanc. Dynamo Co.
Aberdeen Corporation	Dec., 1899	14·4	27·75	4 8½	96 G	13	42·5	83	*14	14	V. Cp. C.	4,610	British T-H. / Macartney & Co.
Aberdeen Suburban Trys. Co. ..	June, 1905	5	5	4 8½	95 G	28	90	9	..	..	..	..	J. G. White & Co. / Brush Co.
Accrington Corporation	Aug., 1907	7	10·66	4 0	95 G	14	..	32	*8	8	..	1,888	Brush Co.
Airdrie & Coatbridge Tramway Co.	Feb., 1904	3·63	4·94	4 8½	94 G	14	210	15	..	..	..	..	Brush Co.
Ashton-under-Lyne Corporation ..	Aug., 1902	7	8·15	4 7¾	96 G	10	40	25	5	5	..	400	Dick, Kerr, & Co. / Siemens Bros.
Ayr Corporation	Sept., 1901	6	7·612	4 8½	90 G	21	45	24	*8	8	..	400	British T-H.
Bacup Corporation	1910	1·50	2	4 8½	103 G	9	40	..	..	..	..	..	
Barking Town Urban District ..	Dec., 1903	2·6	3·125	4 8½	100 G	25	44	9	4	3	V. Cp. C.	200	Blackwell & Co.
Barnsley & Dist. Elec. Traction Co.	Nov., 1902	3·06	4·25	4 8½	97 G	10	60	13	*	..	..	..	J. G. White & Co. / Brush Co.
Barrow-in-Furness	Feb., 1904	6·9	10·32	4 0	90 G	13	50	24	*8	..	..	..	Brush Co. / Dick, Kerr, & Co.
Bath Electric Tramways, Ltd. ..	Jan., 1904	14·7	19·3	4 8½	95 G	10·7	38	40	4	4	H.T. Cp.	675	Westinghouse
Batley Corporation	Aug., 1903	6·536	10·47	4 8½	104 G	9	40	15	6	4	H. Cp.	240	B. I. W. Co. / British Elc. Cr. Co
Belfast City	Dec., 1905	49·65	98·54	4 8½	105 G	15	35	291	3	3	Tri. Exp.	3,000	J. G. White & Co. / Westinghouse
Bessbrook—Newry (1) .. .. Bessbrook and Newry Try. Co.	Oct., 1885	3	3	3 0	41 V	80	55	2 M / 2 T	2	1	Hyd. Turb	..	Mather & Platt
Bexley Urban District	Oct., 1903	5·25	6·5	4 8½	90 G	14	40	21	3	3	V. Cp.	600	Dick, Kerr, & Co.
Birkenhead Corporation	Feb., 1901	13·8	24·09	4 8½	100 G	13½	40	65	6	6	V. Cp.	..	Blackwell & Co. / British T-H.
Birmingham Corporation	Jan., 1904	65·56	114·55	3 6	105 G	13	40	586	..	..	..	1,475	Dick, Kerr, & Co.
Birmingham and Midland Trys. Co.	Nov, 1904	10·32	16·45	3 6	85 & 94 G	15	31	62	6	6	Cp.	..	Brush Co.
Blackburn Corporation	March, 1899	14·67	24·75	4 0	92 G	15	30	61	*4	4	V. Cp. C.	..	British T-H. / Blackwell & Co.
Blackpool Corporation	Oct., 1885	14·75	21·38	4 8½	96 G	20	36	84	5	..	Turb.	3,250	Elwell-Parker / British T-H.
Blackpool & Fleetwood Tramrd. Co.	July, 1898	7·9	15	4 8½	70 V / 98 G	26	80	41	5	5	V. Cp.	600	Mather & Platt / D.K.&Co.-B.T-H.
Blackpool and Fylde Light Ry. Co.	Under cons.	14	14·5	4 8½	..	..	..	..	..	..	..	..	
Blackpool—St. Anne's & Lytham ..	May, 1903	7·47	14·03	4 8½	92 G	22	35	40	..	..	..	..	British T-H.
Bolton Corporation	Nov., 1899	26	47·21	4 8½	90G	14	35	112	*12	12	V. Cp. C.	3,800	Dick, Kerr, & Co. / Blackwell & Co.
Bootle Corporation	May, 1900	4·125	7·75	4 8½	95 G	20	40	55	*8	8	..	4,000	Blackwell & Co.
Bournemouth Corporation	July, 1902	21·66	31·75	3 6	100 G / 66 slot	10	40	91	5	4	V. Cp.	1,200	J. G. White & Co.
Bradford Corporation	July, 1898	59	108·75	4 0	102 G	9·8	40	‡272	11	11	V. Cp. C.	..	Westinghouse / Blackwell & Co.
Bray and Enniskerry Railway Co.	Under cons.	3·25	5	3 6	..	..	..	..	..	..	..	..	
Brighton Corporation	Nov., 1901	9·48	17·18	3 6	105 B.S. No. 4	9	40	53	5	5	Turb.	1,000	Macartney & Co. / Westinghouse / Blackwell & Co.
Brighton Beach (1)	Aug., 1883	1·75	2	2 8½	35 V	100	80	9	2	..	..	..	Siemens Bros.
Bristol—Bristol Trys. Co.	Oct., 1895	31	57·5	4 8½	92½ G	10	30	232	6	4	V. Cp. C.	..	British T-H. and / Blackwell & Co.
Burnley Corporation	Dec., 1901	12·50	22·16	4 0	102 & 107 G	9·8	35	67	*8	6	H. Cp. C.	1,500	British T-H.
Burton and Ashby Light Railway ..	July, 1906	10·2	12·3	3 6	90 G	11	51	20	2	2	Diesel	330	Dick, Kerr & Co. / Brush Co.
Burton-on-Trent Corporation ..	Aug., 1903	6·67	9·75	3 6	90 & 100 G	11·7	40	20	3	3	V. Cp.	400	Dick, Kerr, & Co. / Blackwell & Co.
Bury Corporation	June, 1903	22·5	34·42	4 8½	102¾ G	12	40	54	6	6	..	1,500	Westinghouse
Camborne and Redruth	Nov., 1902	3·75	4	3 6	83 G	15	40	8	7	7	Cp.	1,525	Dick, Kerr, & Co. / British T-H.
Cardiff Corporation	May, 1902	17·25	31·82	4 8½	100 G	23	35	130	9	9	V. Cp. C&T	2,200	British T-H. / Dick, Kerr, & Co.
Carlisle, City of, Elec. Try. Co. ..	June, 1900	7·25	8·5	3 6	83 G	14	23	15	4	4	..	..	D.K.& Co.-B.T-H.
Cavehill & Whitewell Try. Co...	Feb., 1906	3·29	4·31	4 9	105 G	31	75	10	..	..	..	..	J. G. White & Co.
Chatham & District Light Rly. Co.	June, 1902	14·98	26	3 6	92½ & 105 G	9	35	50	5	4	H. Cp.	675	British T-H. Co. / Brush Co.
Cheltenham and District ..	Aug., 1901	10·22	12·25	3 6	80 & 90 G	8·9	37	20	2	2	V. Cp.	..	Westinghouse
Chester Corporation	April, 1903	3·59	6·4	3 6	94 & 100 G	23	40	18	*7	6 / 1	V. Cp. C. / V. Tri. ExC	240	Blackwell & Co. / British T-H.
Chesterfield Corporation	Dec., 1904	3·6	5·1	4 8½	96 & / 101 G	20	40	17	4	4	V. Cp. C.	800	Milnes & Co. / Westinghouse / Brush
Clontarf and Hill of Howth ..	July, 1900	5·5	6·5	5 3	90 & 60 G	13	34	12	..	..	..	..	W.M. Murphy & Co.
Colchester Corporation	July, 1904	6	7·94	3 6	95 G	12	43	18	8	8	V. Cp.	1,140	Dick, Kerr & Co. / J. G. White & Co.
Colne Corporation Tramways ..	Nov., 1903	5·2	6·7	4 0	102 G	13	60	13	*	..	..	..	Blackwell & B.T-H. / Glover & Co.
Cork Elec. Try. & Lighting Co. ..	Dec., 1898	10	15	2 11½	83 G	14	26	35	*9	9	H. Cp. C.	570	British T-H. / Blackwell & Co.
Coventry Corporation Tramways..	Dec., 1895	12·88	15·81	3 6	65 G / 81 G	16	35	51	5	3	H. & V. Cp.	1,500	Westinghouse / Blackwell & Co.
Croydon Corporation	Sept., 1901	11·87	19·12	4 8½	96·5 G	16	40	75	*13	13	..	2,000	British T-H. Co.
Darlington Corporation	June, 1904	4·875	8·88	3 6	90 G	14	52·8	18	1	..	..	250	Westinghouse

* Current from combined lighting and traction station. (1) Third rail system. † Includes 1·25 miles railless trolley line. ‡ Includes 20 railless cars.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Dartford U. D. C.	Feb., 1906	6·5	8·5	4 8½	100 G	12	35	12	4	..	..	..	British I. W.
Darwen Corporation	Oct., 1900	4·36	7·16	4 0	95 G	9	35	19	*4	4	H. Cp.	..	British T-H.
Derby and Ashbourne	..	14·5	..	4 8½									
Derby Corporation	July, 1904	13	22·06	4 0	95 G	14	46	50	3	3	Turb.	..	J. G. White & Co. Brush & B.T-H.
Devonport Corporation	June, 1901	..	7	3 6	97 G	10	50	12	..	..	..	..	Blackwell & Co.
Doncaster Corporation	June, 1902	8·25	12·52	4 8½	94 G	16	45	32	8	8	..	1,000	Blackwell & Co.
Dover Corporation	Sept., 1897	4·75	7	3 6	87 & 90 G	10	44	24	*2	2	H.CC.	..	D. K. & B. T-H
Douglas—Port Soderick .. Douglas Southern Elec. Trys. Co.	Aug., 1896	3·25	3·75	4 8½	65 V	12	45	8 M 8 T	2	2	H. Cp.	200	Westinghouse British T-H.
Dublin & Lucan Elec. Railway Co.	March, 1900	6·5	7	3 6	50 V	20	27	9 M 5 T	2	2	H. Cp.C.	240	Dick, Kerr, & Co.
Dublin United Tramways Co.	May, 1896	49·8	95·26	5 3	105 G	12·3	22	365	8	8	Cp. & Tur	5,500	Dick, Kerr, & Co. Blackwell & Co. British T-H.
Dudley and Stourbridge Trys. British Electric Traction Co.	July, 1899	22·88	30·97	3 6	90 G	11	50	59	4	4	H. Cp.	..	British T-H. Blackwell & Co.
Dumbarton	Feb., 1907	13	17	4 7¾	90 & 96	14	60	30	3	3	..	..	Dick, Kerr, & Co.
Dundalk	Under cons.	6	6·25	3 6	97 G	10	50	12					White & B.T-H.
Dundee, Broughty Ferry, and District	Dec., 1905	4·125	7·25	4 8½	90 G	16·5	30½	14	3	3	V. Cp.C.	..	J. G. White & Co British T-H. Co.
Dundee Corporation	July, 1900	16·3	30·25	4 8½	90 & 100 G	10	35	76	5	5	..	..	Blackwell & Co.
Dunfermline (Fife Try. & Power Co.)	Nov., 1909	14·6	17·4	..	90 G	10	25	28	..	..	..	..	British T-H
East Ham Corporation	June, 1901	7·58	14·20	4 8½	90 & 105 G	25	40	45	*5	5	H. Cp.	750	Dick, Kerr, & Co.
Eccles Corporation	May, 1902	5	7·75	4 8½	100 G	..	..	..	..	..	..	..	
Edinburgh and District	June, 1910	1·25	1·5	4 8½	100 G	21	54	4	..	..	..	..	Dick, Kerr, & Co.
Erith Urban District Council	Aug., 1905	4·7	8·4	4 8½	100 G	17	40	17	3	5	..	..	Brush Co. Westinghouse Co.
Exeter Corporation	April, 1905	4·875	7	3 6	90 G	11·5	35	24	*4	4	H. Cp.	..	Dick, Kerr, & Co.
Falkirk and District	Oct. 1905	7·81	10·5	4 0	90 G.	11·3	48	18	*	..	..	..	Bruce Peebles & Co. British T-H.
Farnworth Urban District	Jan., 1902	4·33	7·16	4 8½	98 G	29	36	..	..	..	..	..	
Felixstowe Pier	Aug., 1905	0·5	0·5	3 6	36	..	..	3	..	..	..	..	
Gateshead and District	May, 1901	12·38	20·02	4 8½	90 G	8	35	55	*	..	..	..	Dick, Kerr, & Co. Blackwell & Co.
Giant's Causeway Elec. Try. Co.	Sept., 1883	8	9	3 0	42 V 75 G	24	30	5 M 21 T	2	2	Hyd. Turb.	..	Siemens Bros. British T-H.
Glasgow Corporation	Oct., 1898	99·26	198·13	4 7¾	110 G	11·93	30¾	857	·8	8	V. Cp. & T	21,700	British T-H. Westinghouse
Glossop Urban District	Aug., 1903	4·56	5·6	4 8½	90 G	13	40	8	4	4	V. Cp.	200	British T-H.
Gloucester Corporation Light Rly.	May, 1904	9	15	3 6	90 G	25	40	30	*2	2	Cp.	750	Brush Co. Dick, Kerr, & Co
Gosport & Fareham Trys. Co.	Jan., 1906	7·5	11·5	4 7¾	96 G	16	37½	22	3	3	V. Cp. C.	750	Dick, Kerr, & Co. Brush Co.
Gravesend and Northfleet	Aug., 1902	6·5	9	4 8½	87 G	11	45	18	*				
Great Crosby	June, 1900	2·5	2·5	4 8½	92½ G	..	40	14	*7	7	H. & V. Cp.	160	Dick, Kerr, & Co. Blackwell & Co.
Great Grimsby	Dec., 1901	6	11	4 8½	90 G	15	26	32 M 6 T	3	3	..	400	Dick, Kerr, & Co.
Greenock and Port Glasgow	Oct., 1901	7·425	14·05	4 7¾	90 G	11	60	42	*	..	..	..	
Guernsey Railway Co.	Nov., 1892	3	3	4 8½	74 V 84 G	60	60	9 M 8 T	2	1	H. & V. Cp.	160	Siemens Bros. British T-H.
Halifax Corporation	June, 1898	37·53	55·5	3 6	95½ G	9·5	38·6	101	*7	7	H. & V. Cp. & T.	3,000	Electric Cons. Co. British T-H.
Hampshire Light Railway (Elec.) Co.	March, 1903	6	9	4 8½	..	..	..	10	*	..	..	..	
Haslingden Corporation	July, 1908	3	3	4 0	100 G	10	30	..	..	..	..	45	Dick, Kerr, & Co.
Hastings and District	July, 1905	19·33	34	3 6	90 G	8	30	65	6	6	V. Cp.	2,100	Dick, Kerr, & Co.
Herne Bay Pier (1)	March, 1899	·75	·75	3 0	60	..	..	3	1	1	Gas	50	British T-H.
Heywood Corporation	Dec., 1905	4·25	4·25	4 8½	90 G	17	..	..	1	1	..	300	Blackwell & Co. B.I. & H.C. Co.
Houghton-le-Spring (See Sunderland Dist. Elec. Trys.)													
Huddersfield Corporation	Feb., 1901	34·50	56	4 7¾	98 G	11	35	106	4	4	V. Cp. C.	2,200	British T-H.
Hull Corporation	July, 1899	13·46	30·5	4 8½	94 G	20	30	180	7	7	V. Cp. C.	2,560	British T-H. Westinghouse
Ilford Urban District	Mar., 1903	7·42	12·62	4 8½	95 G	13	33·3	28	*7	7	..	1,600	British T-H. Dick, Kerr, & Co.
Ilkeston Corporation	May, 1903	3·8	4·3	3 6	90 G	12	28	13	..	..	..	..	Dick, Kerr, & Co.
Ipswich Corporation	Nov., 1903	10·8	14·87	3 6	90 G	11·5	40	36	*10	10	Enclos'd	1,175	Westinghouse
Isle of Man— Manx Elc. Rly. Co. Douglas to Ramsey ..	July, 1893	18	35·75	3 0	62½ V	24	90	34 M 29 T	8	9	H. Cp.	1,300	Mather & Platt
Manx Elc. Rly. Co. Snaefell Mountain ..	Aug., 1895	4·5	9·5	3 6	56 V	12	90	6	5	4	H. Cp.	390	
Isle of Thanet Trys. & Ltg. Co.	April, 1901	11	20·67	3 6	90 & 100 G	11	38	59	*6	6	3 V. Cp. 3 H. Cp.	800	British T-H. Blackwell & Co.
Jarrow and District	Nov., 1906	2·54	3·42	4 8½	95 G	12·5	50	10	..	..	..	..	Brush Co. B.I. & H.C. Co.
Kearsley Urban District	Jan., 1902	1·75	1·75	4 8½	95 G	20	..	..	..	..	..	..	Westinghouse
Keighley Corporation	Oct., 1904	3·5	6·11	4 0	95 G	25	60	12	*4	4	V.	200	Blackwell & Co. Brush & B.T-H.
Kidderminster—Stourport British Electric Traction Co.	May, 1898	4·6	4·87	3 6	75 G	14	45	13	*5	5	Stm Turb.	..	Brush Elc. Eg. Co.
Kilmarnock Corporation	Dec., 1904	4·18	5·5	4 8½	90 G	24	45	14	*3	3	..	250	Blackwell & Co.
King's Norton & Northfield U. D.	May, 1904	5·25	8·25	3 6	105 G	15&21	100&145	..	..	..	..	..	Blackwell & Co.
Kinver	April, 1901	4·25	6	3 6	63 & 90 G	..	..	6					
Kirkcaldy Corporation	Feb., 1903	6·11	8·56	3 6	100 G	11	40	26	*10	6	Cp. H.T.	2,290	British T-H. Co.
Lanarkshire Tramway Co.	July, 1903	28·431	43·120	4 7¾	96 & 101 G	9·4	37	76	·4	4	3 H. Cp. 1 V. Cp.	825	British T-H. Co.
Lancashire United Tramways Co.	Oct., 1902	39	54	4 8½	90 G	15	50	82	*8	8	V. Cp. C & T	7,000	B. I. W. Co.
Lancaster Corporation	Jan., 1903	4	4·81	4 8½	90 G	8	30	12	4	4	V. Cp.	200	Greenwood & Batley, Ltd.
Leamington & Warwick Elec. T. Co.	July, 1905	3·04	6·1	3 6	65 G	12	47	12	3	3	Cp.	..	Brush Co.
Leeds City	Aug., 1897	69·02	114·62	4 8½	105 & 111 G	8·4	32	345	5 3	5 3	H. Cp C. Stm. Tur	6,150	Elec. Con. Co. Greenwood & Batley, British T-H. Blackwell & Co

* Current from combined lighting and traction station. (1) Third Rail system. M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Leicester Corporation	May, 1904	20·25	38	4 8½	100 G	16	35	160	7	7	V.Cp.C&T	9,250	Dick, Kerr, & Co. / Blackwell & Co.
Leith Corporation	Aug., 1905	9·08	17·9	4 8½	106·7 G	19	54	37	*11	11	..	1,600	Brush & B.T-H.
Leyton Urban District	Dec., 1906	8·95	17·694	4 8½	105 & 111 G	24	45	60	*4	4	Cp.T.E&T	2,040	..
Lincoln Corporation (1)	Nov., 1905	1·75	2·96	4 8½	100 G	..	36	8	*9	9	..	120	Blackwell & Co.
Liverpool Corporation	Nov., 1898	70	127	4 8½	95, 123 & 134 G	13	30	599	*42	42	Trip.Ex.	44,600	British T-H. / Dick, Kerr, & Co. / Westinghouse
Liverpool Overh'd Ry. (Trol.Ln.Ex.)	June, 1900	2·5	2·5	4 8½	92½ G	Nil	40	14	7	7	H.&V.Cp.	160	Dick, Kerr, & Co.
Llandudno and Colwyn Bay ..	Oct., 1907	8·37	13·60	3 6	90 G	11·5	45	18	*	..	..	..	Bruce Peebles & Co.
Llanelly and District	July, 1911	6·25	6·75	4 8½	90 G	11·2	60	12	*2	2	Trip.Ex.	..	British T-H.
London County Council (2) ..	May, 1903	148·56	287·35	4 8½	105 G	10·6	45	1725M / 150T	8	8	V. Cp. C. Turbine	43,000	Dick, Kerr, & Co. / Westinghouse
London United Tramways Co. ..	April, 1901	55·25	102·45	4 8½	92½ & 100 G	18	28	339	7	5	V. Cp.	3,500	British T-H. / Westinghouse. / Blackwell & Co.
Lowestoft Corporation	July, 1903	4·75	5·07	3 6	100 G	27	36	19	*5	5	Cp.	..	Blackwell & Co.
Luton Corporation Tramways (Leased to J. G. White & Co., Ltd.) ..	Feb., 1908	5·25	6·25	4 8½	95 G	11	35	12	*1	1	..	..	J. G. White & Co. / British T-H.
Maidstone Corporation	July, 1904	5·5	7·04	3 6½	96 G	9	35	19	6	6	..	300	Dick, Kerr & Co.
Manchester Corporation	June, 1901	120·05	244	4 8½	105 G	14·9	35	685	*22	22	Turb'nes	45,300	British T-H. / Dick, Kerr, & Co.
Mansfield and District Co. ..	July, 1905	10	12·25	4 8½	90 G	17	50	24	*3	3	..	..	..
Merthyr	April, 1901	3·69	4·81	3 6	96 G	11	66	16	*4	4	H.S.V.	..	D. K. & B. T-H
Metropolitan Electric Trys., Ltd.	July, 1904	56·25	112·5	4 8½	100 G	12	40	312	5	5	1 Stm. Tur	..	British T-H. / Brush Co.
Mexborough & Swinton Trys. Co.	Feb., 1907	7·75	10·75	4 8½	90 G	8·5	55	20	4	4	Turb.	700	Brush & B.T-H.
Middlesbro', Stockton, & Thornaby Electric Tramways Co.	July, 1898	10·5	15·825	3 6	92½ G	17	35	60	3	4	H.&V.Cp.	900	British T-H. / Blackwell & Co.
Middlesex County Council.. ..	Aug., 1904	25·5	51	4 8½	..	..	..	..	..	..	..	..	
Middleton Corporation	March, 1902	2·5	5	4 8½	..	..	..	..	..	..	..	..	
Middleton Electric Traction Co. ..	March, 1902	8·5	10·53	4 8½	90 G	15	49½	28	3	3	..	500	Glover & Co.
Morecambe	Jan., 1912	1·20	..	4 8½	96 G	18	..	4	..	..	..	..	
Musselburgh and District ..	Dec., 1904	6·5	8·125	4 8½	90 G	34	45	16	4	3	..	400	B. T-H. Co., Nat. Elec. Cons. Co.
Nelson Corporation	Feb., 1903	2·74	3·86	4 0	106 G	11	41	11	*4	4	..	400	Blackwell & Co. / British T-H. Co. / Brush Co.
New St. Helens & District Trys. Co.	July, 1899	18	20	4 8½	95 G	13	35	36	*4	4	V.Cp.C.	..	Westinghouse / British T-H.
Newcastle Corporation	Dec., 1901	32·75	62·875	4 8½	101 G	11	37	220M / 2T	6	6	V.Cp.Trip. Ex.&Turb.	11,000	Westinghouse / British T-H.
Newport (Mon.) Corporation ..	April, 1903	7·5	14·35	4 8½	98 G	10·5	40	44	5	5	V. Cp.	1,750	Westinghouse
Northampton Corporation	July, 1904	6·5	11·16	3 6	90 & 96 G	18	50	33	4	4	V.C.C.&T	1,020	Dick, Kerr, & Co. / Brush Co.
North Shields Tramways Co. ..	March, 1901	..	7·75	3 6	90 G	10	36	22					
North Staff. Trys. (*vide* Potteries)													
Norwich Electric Tramways Co. ..	July, 1900	14·5	19·25	3 6	65½ & 90 G	12·6	38	42	6	5	H.TCp&T	1,000	Westinghouse / Blackwell & Co
Nottingham Corporation	Jan., 1901	21·5	41·5	4 8½	107 G	11·5	40	155	*3	3	..	..	British T-H. / Dick, Kerr, & Co.
Nottinghamshire & Derbyshire Tramways Co.	Aug., 1913	12·8	16·10	4 8½	G	..	..	24	*	..	..	..	British T-H.
Oldham, Ashton & Hyde Trys. Co.	June, 1899	9·12	11·75	4 8½	97 G	11	28	46	*3	3	V.Cp.C.	..	British T-H.
Oldham Corporation	Dec., 1900	24	37	4 8½	100 & 105 G	10·5	40	109	*4	4	..	2,220	Dick, Kerr, & Co.
Paisley & District Tramways Co.	June, 1904	18·25	32·50	4 7⅞	90 G	10	34	60	..	..	..	..	British T-H.
Perth Corporation	Oct., 1905	4·846	6·75	3 6	90 G	16	25	12	5	5	Cp.	500	Blackwell & Co.
Peterborough Elec. Traction Co...	Jan., 1903	5·33	6·71	3 6	94 G	31	35	14	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co.
Plymouth Corporation	Sept., 1899	7·75	15	3 6	92 G	9	35	42	3	3	V. Cp.	..	Elec. Cons. Co. / Westinghouse
Plymouth, Stonehouse, and Devonport	Nov., 1901	1·5	3·62	3 6	84 G	11	34	15	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co.
Pontypridd Urban District ..	March, 1905	5·5	8·6	3 6	96 & 100 G	10	27·6	26	4	5	V.C.Cp.	450	B.I.W. & B.T-H. / Blackwell & Co.
Portmadoc & South Snowdon Rly.	Under cons.	13·25	15	1 11½	41	28	200	6	..	..	..	..	
Portsdown & Horndean Tramway	March, 1903	6	7·5	4 7⅞	96 G	16	40	16	2	2	Oil	200	Dick, Kerr, & Co. / Brush Co.
Portsmouth Corporation	Sept., 1901	17·65	34·63	4 7⅞	96 & 100 G	17	35	100	5	4	V.& H.Cp.	2,075	Macartney & Co. / Dick, Kerr, & Co.
Potteries Electric Traction Co. ..	May, 1899	31·67	41·48	4 0	87, 90, 100, & 110 G	11	45	110	8	8	H.Cp. / V.Cp.	2,275	Dick, Kerr, & Co. / Blackwell & B.T-H.
Preston Corporation..	June, 1904	10·54	17·2	4 8½	B.S.S.No.2	16	28	39	2	2	H.Cp.	600	Dick, Kerr, & Co.
Radcliffe Urban District ..	April, 1905	5	6·5	4 8½	100 G	15	40	..	*4	4	V. Cp.	600	Mather & Platt
Rawtenstall Corporation	May, 1909	12	15·9	4 0	100 G	15	38	24	*3	3	..	850	Westinghouse
Reading Corporation	July, 1903	7·44	13·175	4 0	96 G	16	35	36	4	4	V. Cp.	400	Blackwell & Co. / Dick, Kerr, & Co / Westinghouse
Rhondda Tramways Co.	July, 1908	21	28·75	3 6	95 G	9	38½	54	7	4	Trip.Ex.	1,230	British T-H. / Brush
Rochdale Corporation	May, 1902	19·58 (A)	22·74 (A)	4 8½	103½ G	11·7	30	69	*	..	..	..	British T-H. / Dick, Kerr, & Co / Brush Co.
Rotherham Corporation	Jan., 1903	10	12	4 8½	100 G	9·5	45	36	*6	6	H.S.Cp.	1,485	Dick, Kerr, & Co.
Rothesay	June, 1902	4·81	9·68	3 6	94 G / 77 G	24	34	20	3	3	V. & Oil	350	Dick, Kerr, & Co / Westinghouse
Ryde Pier, Isle of Wight Ryde Pier Co. (3) ..	March, 1886	·5	1	4 8½	30 & 34 V	..	..	4	2	2	Gas	..	Siemens Bros.
Salford Corporation	Oct., 1901	41·90	75·79	4 8½	103 G	20	42·5	220	*7	7	C. & Turb.	3,000	Westinghouse / Mather & Platt
Scarborough Tramways Co. ..	May 1904	5	7·75	3 6	90 G	10·5	35	22	2	2	Stm.Turb.	..	Brush & B.T-H.
Sheerness and District	April, 1903	2·5	2·704	3 6	94 G	43	40	8	6	5	V.Cp.C.	100	Siemens & Halske / Brush Co.
Sheffield Corporation	Sept., 1899	40	77·84	4 8½	110 & 120	9·5	35	339	..	..	..	..	British T-H

* Current from combined lighting and traction station. (1) G.B. surface contact system. (2) Mainly Conduit system, but there are now several Trolley lines.
Besides the electric lines the London County Council has also 4·45 route miles of horse tramways. (3) Third rail system. (A) Not including 17·2 miles track leased.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS (contd.).	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
				ft. in.	lbs.	1 in	ft. rad.						
Shipley Urban District	May, 1902	6	10	4 0	98 G	15	..	..	6	6	Turbine	1,800	British T-H.
Soothill Nether U.D.C. & Dewsbury & Ossett Corporations ..	Nov., 1908	3·125	4·45	4 8½	90 G	13	50	8	*	..	..	..	Nat. Elec. Cons. Co.
Southampton Corporation	Jan., 1899	10·25	18·75	4 8½	{96 G&105 B.S. No. 4}	13	40	73	6	6	H. Cp. C.	1,000	Westinghouse
Southend Corporation	July, 1901	7·01	13·52	3 6	90 G	18	48	42	*6	7	V. Cp.	2,075	British T-H.
Southend Pier (1) Southend Corp.	Aug., 1890	1·25	1·25	3 6	60 G	Lev.	..	25	..	..	..	..	British T-H.
South Metropolitan Elec. Try. Co.	Feb., 1906	13·09	26	4 8½	95 G	16	42	51	*8	6	Stm Tbs	1,650	Dick, Kerr & Co. / Brush Co.
Southport Corporation (5)	July, 1900	13·5	10·75	4 8½	87 & 90 G	25	45	30	*3	3	H. Cp.	600	Dick, Kerr, & Co.
Southport Electric Tramway Co...	July, 1901	8·17	12·52	4 8½	87 G	Nil	40	21	*				
Southport Pier	1905	..	·75	4 0	..	..	..	1 M 2 T	..	..	..	..	Westinghouse
South Shields Corporation ..	March, 1906	5·7	10·25	4 8½	95 G	15	35	40	2	2	V. Cp. C.	1,100	Dick, Kerr & Co.
South Staffordshire	Jan., 1893	16·90	26·87	3 6	97 & 90 G	17	46	46	3	3	C.H. Cp.	..	Blackwell & Co. / E. C. C.
Stalybridge, Hyde, Mossley, and Dukinfield	May, 1904	21·186	27·75	4 8½	99 G	9	27½	59	8	..	Turb.	1,000	Dick, Kerr, & Co.
Stockport Corporation	Aug., 1901	16	27·62	4 8½	96 G	10·8	35	50	*5	5	Cp.	1,000	Dick, Kerr, & Co.
Sunderland Corporation	Aug., 1900	10·92	20·35	4 8½	96 G	12	36	70	*	..	..	936	Dick, Kerr, & Co.
Sunderland District Electric Trys.	June, 1905	14·27	15·97	4 8½	90 G	11	40	33	*	..	..	..	British T-H.
Sutton & Howth (G.N.R., Ireland)	June, 1901	5·3	6	5 3	72 B	16·7	300	11	3	3	V. Cp.	500	British T-H. / Westinghouse
Swansea Tramways Company ..	June, 1900	13·02	20·38	4 8½	84 & 86 G	14	45	75	3	3	H. Cp. C.	620	British T-H.
Swindon Corporation	Sept., 1904	3·7	4·4	3 6	105 G	14	37	12	5	4	..	600	Dick, Kerr & Co.
Taunton Electric Traction Co.	Aug., 1901	1·66	2	3 6	90 G	25	35	6	*	..	..	..	Blackwell & Co.
Torquay Tramways	April, 1907	9·76	17·04	3 6	90 G	10	31	33	*	..	..	..	British T-H.
Trafford Park Estates, Ltd. (Trys.)	July, 1903	2·5	2·75	4 8½	100 G	Nil	35	..	..	..	..	..	
Tynemouth and District	March, 1901	4·21	7·83	3 6	90 G	10	30	21	*3	3	..	..	Blackwell & B.T-H.
Tyneside Tramways & Tramroads Co.	Sept., 1902	10·97	16·23	4 8½	95 G	10	40	24	*				
Wallasey Corporation	March, 1902	12	20	4 8½	98 G	11	40	67	*1	1	Turbine	1,000	Blackwell & Co.
Walsall Corporation	Jan., 1904	13·5	19·5	3 6	90 & 92 G	18·5	32	39	*7	7	V & Tur.	2,490	British T-H.
Walthamstow U.D.C. Light Rly...	June, 1905	9·14	12·53	4 8½	100 G	18	40	38	*15	12	{Gas & Turb's}	1,560	Westinghouse
Walton-on-Naze Pier	Aug., 1898	·5	·5	3 6	36 V	..	..	3	3	2	..	100	Blackwell & Co.
Warrington Corporation	April, 1902	6·5	9·6	4 8½	90 G	27	50	21	*6	6	V.C.	500	British T-H.
Wemyss and District	Aug., 1906	7·5	13	3 6	{95 & 97 G}	18	85	17	3	3	2 V. Cp.	..	BrucePeebles&Co
West Bromwich Corporation ..	Dec., 1902	7	12·5	3 6	98 G	20	49	29	8	8	Turb'nes	750	Dick, Kerr, & Co. / B. I. W. Co.
West Ham Corporation	Feb., 1904	16·8	30·0	4 8½	100 G	18	40	118	*3	3	V.C.Cp.	1,500	Brush & B.T-H.
West Hartlepool Corporation ..	May, 1896	6·72	8.3	3 6	87 & 90 G	15	35	25	*	..	..	..	Elec. Cons. Co. / Dick Kerr & Co.
Weston-super-Mare	May, 1902	2·92	3·53	4 8½	90 G	25	40	12	5	4	Cp. & T.	..	Blackwell & Co. / British T-H. / Brush Co.
Wigan Corporation	Jan., 1901	30·9	45·42	{3 6 / 4 8½}	105 G	12	45	73	*8	8	..	740	Blackwell & Co.
Wolverhampton Corporation (3) ..	April, 1902	13·5	22	3 6	91 G	15	37·5	52	*10	10	{H.&V.C. & Turb's}	2,900	British T-H. / Electric Cons. Co.
Wolverhampton District	Oct., 1900	15·51	22·72	3 6	90 G	20	40	30	*4	..	..	..	B.I.W. & B.T-H. / Westinghouse
Worcester Electric Traction Co. ..	Feb., 1904	5·86	8·58	3 6	94 G	13	45	15	*3	3	..	..	Brush Co. / Dick, Kerr, & Co.
Wrexham and District	April, 1903	4·44	6·16	3 6	96 G	9·11	50	10	*6	..	..	..	British T-H.
Yarmouth Corporation	June, 1902	10	14·4	3 6	90 & 95 G	27	48	35	3	3	Comp.	..	Brush Co. / B.I.W. Co.
York Corporation	Jan., 1910	6	9·9	3 6	100	18	40	3 M. 4 T.	*8	8	V.C.	..	Dick, Kerr, & Co. / Brush & B.T-H.
Yorkshire (West Riding)	Aug., 1904	24·69	40·382	4 8½	96 G	15·5	40	69	9	6	..	1,800	Dick Kerr & Co.
Yorkshire Woollen District ..	Feb., 1903	22·25	36	4 8½	{94 & 100 G}	8	30	69	*	..	..	..	Brush Co. / Dick, Kerr, & Co.
RAILWAYS.													
LONDON AND VICINITY:													
Central London Rly. Co. (1) ..	July, 1900	6·5	13	4 8½	100 V	30	..	68 M. 172 T.	6	6	H. Cp. C.	..	British T-H
City & South London Rly. Co. (1	Dec., 1890	7·25	14·75	4 8½	{60 V / 80 V}	30	120	52 L. 142 T.	(a)	..	..	..	Mather & Platt. / Elec. Cons. Co. / British T-H.
East London Railway (2) ..	April, 1913	5·75	11·5	4 8½	90 B	..	..	(c)	..	..	..	..	
Gt. Northern & City Rly. Co. (2)	Feb., 1904	3·5	7·75	4 8½	85 V	52	660	35 M 45 T	6	..	..	..	British T-H.
Great Western Railway .. (Hammersmith and City line.)	Nov., 1906	4·9	10·5	4 8½	97½ B	60	400	48 M. 80 T	10	10	V. Cp.	..	British T-H. / Elec. Con. Co.
London & North Western Rly. (Euston-Watford line in progress) (2)	May, 1914	41·5	80	4 8½	..	..	..	..	..	..	Turbine	..	Siemens Works / Westinghouse
London & South Western Rly. (Extensions in progress) (1)	Under cons.	47	150	4 8½	..	..	168	84	..	..	Turbine	..	Dick, Kerr & Co. / British T-H / Westinghouse
London, Brighton, and South Coast Railway (4) .. .. (Extensions in progress)	Dec., 1909	22	70	4 8½	..	..	..	16 M. 8 T.	*(d)	..	..	..	British T-H. / Blackwell & Co.
London Electric Railway Co.:													
Baker St. & Waterloo Ry. (2)	March, 1906	7	14·0	4 8½	90 B	60	330	86 M. 72 T.	(a)	..	..	..	Westinghouse / British T-H.
Charing Cross—Hampstead Railway (2)	June, 1907	8	16·5	4 8½	90 B	33	330	60 M. 90 T.	(a)	..	..	..	Westinghouse / British T-H.
Great Northern, Piccadilly & Brompton Rly. (2)	Dec., 1906	9·25	18·5	4 8½	90 B	33	330	72 M. 144 T.	(a)	..	..	..	Westinghouse / British T-H.
Metropolitan Railway (2) ..	Jan., 1905	26	59	4 8½	86 B	44	363	86 M. 172 T	4	4	Turbine	..	Westinghouse / British T-H.
Metropolitan District Railway (and running powers) (2)	July, 1905	41	80·46	4 8½	86 B	40	330	234 M. 286 T.	(a)	..	Turbine	..	British T-H. / Westinghouse
Waterloo and City Rly. (1) ..	Aug., 1898	1·5	3	4 8½	87 B	30	321	17 M. 12 T.	6	6	V. C.	..	Siemens Bros. / Dick, Kerr & Co.
PROVINCES:													
Lancashire and Yorkshire (2) .. (Extensions in progress)	March, 1904	43	85	4 8½	86 B	85	840	88 M. 52 T.	6	5	{1 V.C. / 4 H.C.}	..	Dick, Kerr, & Co.
Liverpool Overhead Rly. Co. (1)	March, 1893	6·5	13·05	4 8½	60 V	40	429	46 M 7 T	7	7	{H.Cp. / V.Cp.}	..	Electric Cons. Co. / Dick, Kerr, & Co.
Mersey Railway (1)	April, 1903	4·5	9	4 8½	86 B	27	528	24 M. 31 T.	5	5	V.Cp.	..	Westinghouse / Elec. & Mfg. Co.
Midland Rly.—Morecambe and Heysham Branch (4)	June, 1908	9·75	19·5	4 8½	..	..	..	3 M. 6 T.	4	4	Gas.	..	Westinghouse / Siemens Bros.
North Eastern Railway (1) ..	March, 1904	35	80	4 8½	90 B	55	792	60 M. 50 T.	(b)	..	..	..	British T-H. Co.

*Power from combined lighting and power station. (1) Third rail system. (2) Third and fourth rails system. (3) Lorain surface contact system. (4) Single phase.
(5) Not including 9 miles owned but leased. (a) Power supplied by Chelsea Power Station (80,000 H.P.) (b) Power purchased from the Newcastle-upon-Tyne Electric Supply Company, Limited. (c) Rolling stock supplied by Metropolitan Railway. (d) Power supplied by London Electric Supply Corporation.
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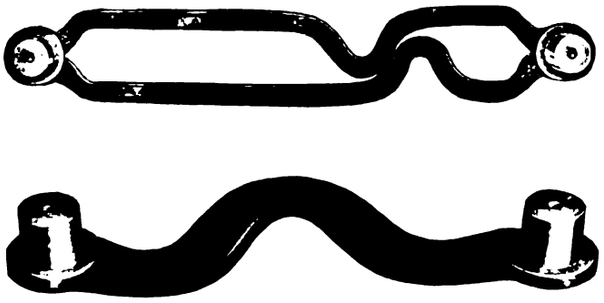

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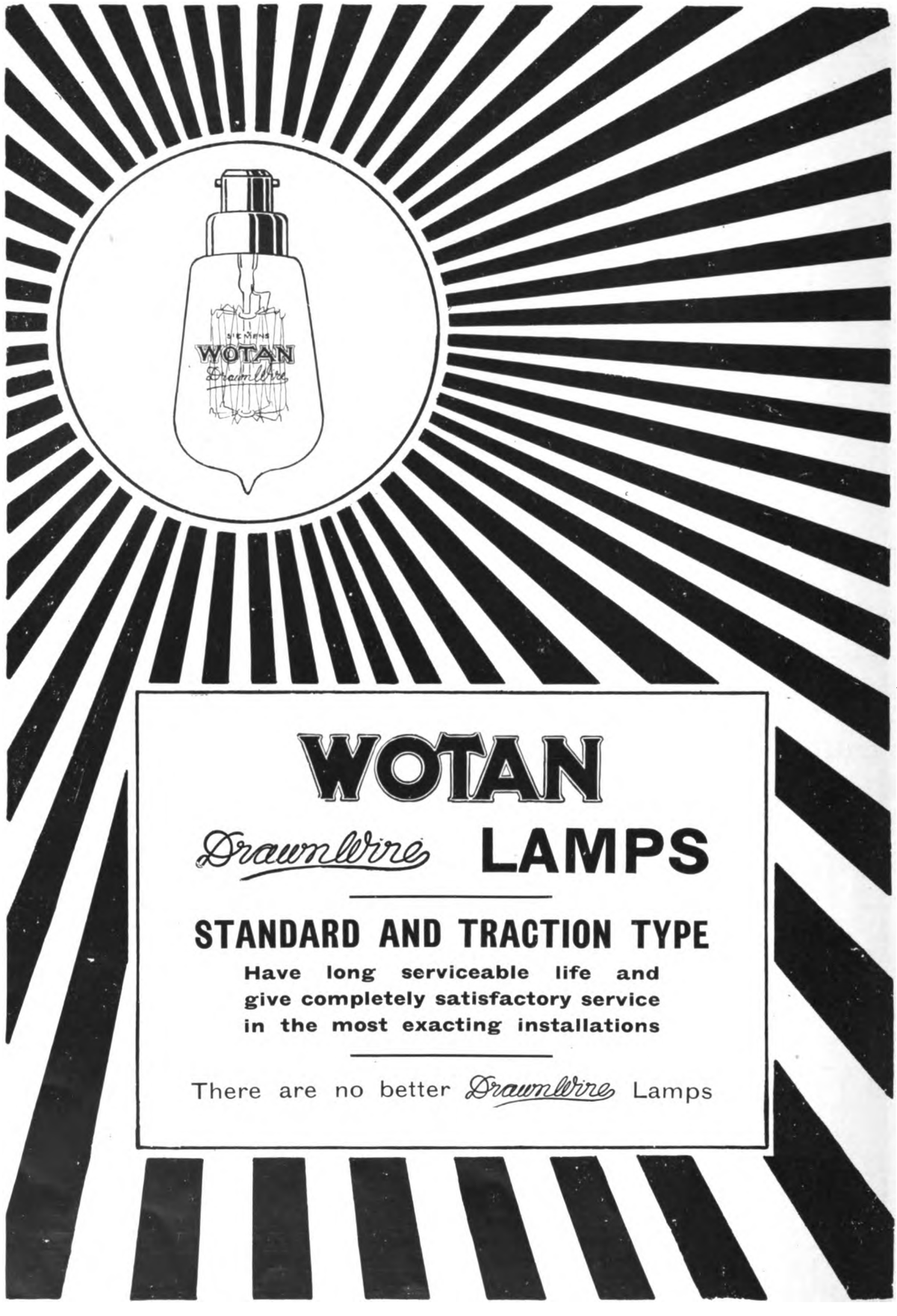

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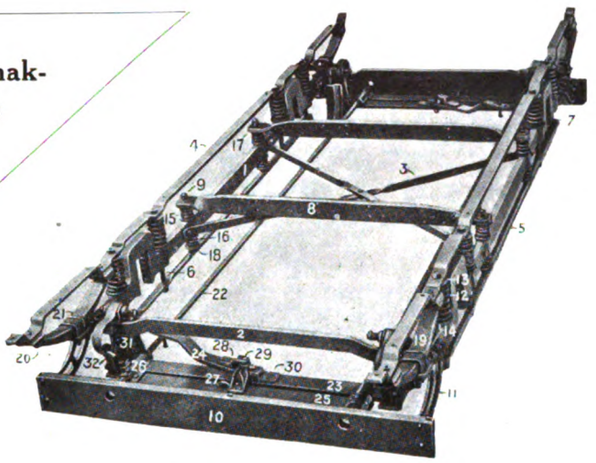

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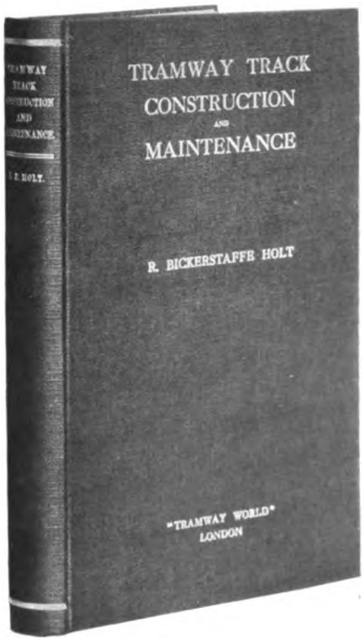

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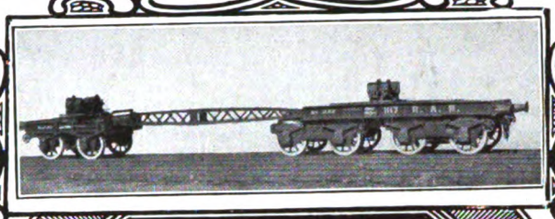

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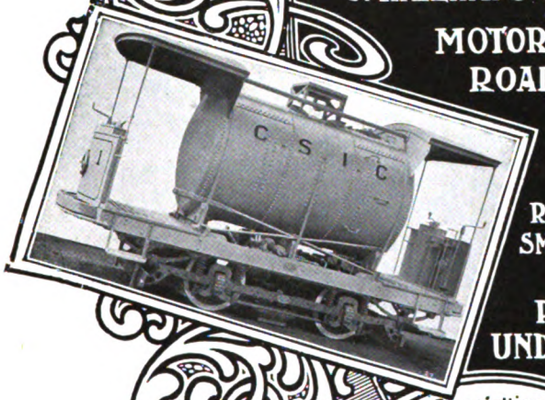

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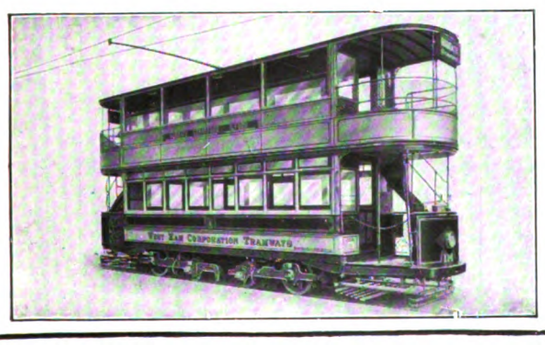

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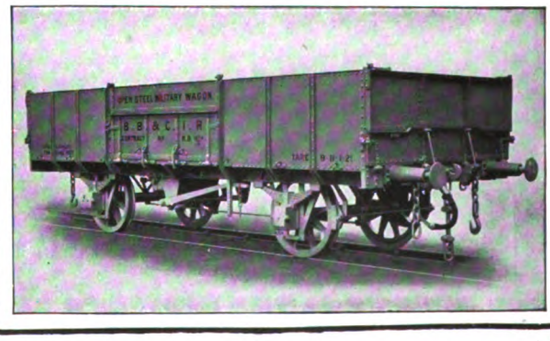

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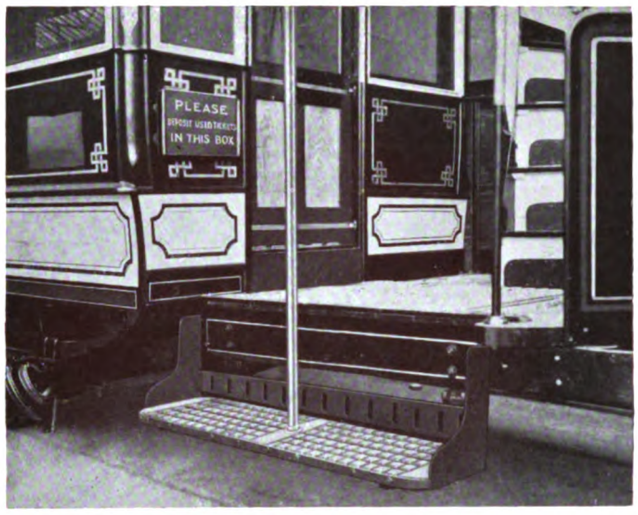

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WAR TIME INNOVATIONS AT NEWCASTLE.

COUPLED MOTOR CARS FOR THE RELIEF OF CONGESTION AND FRONT EXIT CARS TO AVERT DELAY.

With a steady drain upon their car and repair shop hands owing to the demands of the national services, tramway managers have had a difficult task to keep running anything like the number of cars that were in use before the war. However much they may have desired to introduce trailers as a means of relieving the congestion of traffic and the shortage of motormen, the war rendered it practically impossible to obtain delivery of trailers and suitable couplings, owing to the pressure of Government work preventing the execution of other orders. The London County Council Tramways are an exception to the foregoing statement, for two reasons. In their case an order for 150 trailers was given before the outbreak of war. In the second place, trailers brought into service on ordinary routes enable motormen to be freed for augmenting the number of drivers required for the increased services for the conveyance of munition workers. These reasons have much to do with the more frequent delivery of trailers that has been made to the London County Council Tramways during the past two months.

In what direction, then, can a manager turn for relief, apart from the employment of women as conductors and drivers? In the former capacity, women and girls are rendering invaluable service, but less than half a dozen authorities have attempted on a small scale the expedient of women drivers, a course that is now being adopted more extensively on the lighter cars at Glasgow, where thirty-one women have been trained for the task during the past six months.

An answer to the foregoing question may be supplied by a statement of what has been accomplished by Mr. Ernest Hatton, the engineer and general manager of the Newcastle-on-Tyne Corporation Tramways. One invaluable means adopted for keeping cars in service in the Tyneside city is the training of men, ineligible for the forces, as voluntary motormen. Yet even with their assistance the management have not been able, on account of the reduction of the maintenance staff owing to the war, to maintain in service more than 170 of the stock of over 220 cars. Possibly of all the tramway departments in England, the Newcastle Tramways Committee have experienced the most difficult conditions arising from the war. The reason is that the whole of the works in the city are concentrated along the river, and they can thus be served by only one route running practically parallel to the riverside. This, of course, gives rise to considerable congestion. In the evening especially delays are caused to the regular service of cars, as the bulk of the Newcastle cars converge on the Central Station, which is the central point of the route that runs east and west by the side of the river.

On looking round for a means of relieving the congestion, the management were faced by the aforesaid difficulty in respect to trailers. Another consideration presenting itself was that when the present conditions come to an end with the termination of the war, the provision of trailers might not be necessary. It may be argued, however, against the latter aspect of the

Fig. 1.—Coupled Motor Cars with Two-Motor Epuipment.

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question that the restricted configuration of the tramways serving the industrial portion of the city is likely to cause increasing congestion as the years go by, especially as the losses of fighting and trading vessels entailed by the war may be expected to bring a great increase of activity to the Newcastle shipbuilding yards. Another view of the matter is that with increased working the maintenance costs will not be easily reduced after the war, and therefore new means of economical operating must be sought for.

The Newcastle solution of the problem is decidedly noteworthy, and it has the merit of providing an example that can be at once followed on other tramways undertakings. It consists of the use of coupled motor cars, after taking away one motor from the inside axle of each car. We gather from Mr. Hatton (to whom we are indebted for the photographs illustrating this description) that the coupled cars have been running since November of last year in very heavy traffic, and up to now no difficulties have been experienced, nor have there been any accidents to passengers. Moreover, the innovation possesses the same advantage as a trailer in that it enables a tramways authority to do something towards meeting the shortage of motormen.

Fig. 2.—Rigid Bar Spring Coupling Connected to Each Platform.

Fig. 1 shows the two single truck motor cars coupled together, the trolley standard on one being removed. Each car is equipped with one motor on the leading axle, the other being removed. Thus the combination has a simple two-motor equipment. The controllers on the centre platforms have also been removed, leaving a controller at each end of the unit only. Another change is a complete rewiring of the cars on the power circuit. One motorman controls the two cars, and each car has a woman conductor. The route operated over is fairly flat, the maximum gradient being about 1 in 20. Details of the coupling are illustrated in Fig. 2. The coupling consists of a rigid bar spring connected to each car platform, and the power cables pass through tubes fixed on the top and bottom of this coupling bar. To protect passengers the cars are equipped with side guards, as shown in the photograph, these consisting of telescopic rods and tubes, and the device works remarkably well, even on curves of 40 ft. radius. When running after dusk there are lights just under the brake handle in the centre, which are fitted with ruby lamps, to draw the attention of passengers to the fact that there is a car immediately following. This plan has been found to act very well in practice.

While the coupled cars are a little slower than a single car with the same equipment, Mr. Hatton has found that the double units can easily keep up to the schedule time of the many heavy bogie cars with four motor equipment that are running on the same route, while the combination units have the advantage of consuming less energy. On curves their action is remarkably easy, as each car is, of course, alive, there being no drag on the leading car as when followed by a trailer.

By the use of coupled cars as at Newcastle two disadvantages are obviated at termini. With trailer cars certain difficulties have to be overcome at a terminus unless there is a really effective coupling gear. Coupled cars do not have to be shunted at each end of the line as is the case with trailers when there is not a loop to turn round on. Mr. Hatton does not contend that the coupled unit would be economical on light traffic, i.e., unless, for instance, a route required a five minutes' service, and owing to the lack of motormen the five minutes' service could not be maintained, then the same carrying capacity could be provided by the use of coupled cars every ten minutes. No doubt traffic would be lost on such a route owing to the longer intervals, but the demand would be met in some measure by the greater accommodation of the two cars.

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SINGLE DECK BOGIE CARS WITH FRONT EXIT.

The great augmentation of the workmen's traffic has led Mr. Hatton to make a very profitable use of some of the sixty single-deck bogie cars in possession of the Newcastle tramways department. Various alterations have been made in these cars, and the front platform has been adapted for use as an exit. Diverse views are held on the subject of the suitability of the front exit during the rush traffic period, but we have often urged its advantages in these columns. As the Newcastle car is being tested in both busy and slack times, it will be interesting to learn whether experience there serves to bear out what is perhaps the main objection urged against it, viz., the greater possibility of loss of fares by passengers leaving without paying. Another assertion is that there is a greater liability of accident to passengers. As far as we can see the only risk in that direction is that passengers who at present are prevented, or warned, by energetic conductors from alighting in the face of oncoming traffic will have nothing to deter them from doing so at the motormen's end.

As a set-off to that it should be an easy matter to instruct the drivers to warn passengers about to alight when there is need so to do. There is one direction, however, in which the front exit should bring about a great diminution in accidents, viz., mishaps sustained by alighting when a car is in motion. So far the

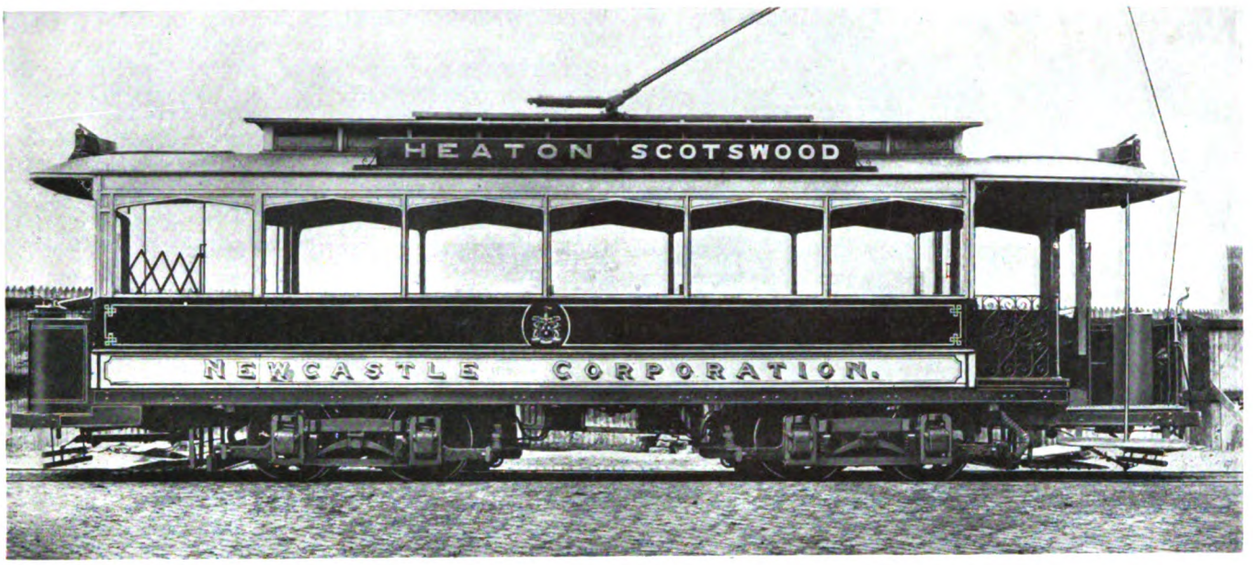

Fig. 3.—Original Form of Car with Rear Entrance only.

Fig. 4.—The same Car as Altered and Provided with Front Exit and Increased Passenger Accommodation.

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foregoing objections have not been substantiated at Newcastle.

In Fig. 3 the car is shown in its original condition, and in Fig. 4 the same car is seen after alteration. In considering the proposal the first scheme was to provide a car to deal with the heavy workmen's traffic with no seating accommodation at all, thus making every passenger a straphanger in order to carry as many persons as possible. As the alterations progressed, however, it became evident that the car could be made more serviceable for general traffic by arranging the seating accommodation and still leave plenty of standing room. A design was consequently evolved for providing seats for six smokers at each end of the car, while the interior has room for 30 non-smokers, making a total of 42 seats. The old type, which was fitted with garden seats, only carried 37 seated passengers, and 18 standing. As altered the car can comfortably carry 80 persons during rush traffic.

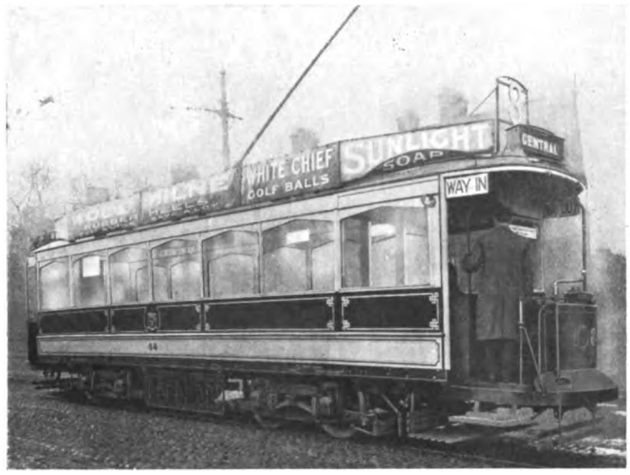

Fig. 5.—A Passenger Boarding at the Rear End.

Fig. 6.—A Passenger Alighting from the Motorman's End.

A noticeable improvement is that the floor under the seats in the interior is raised three inches above the old floor level, so that straphangers cannot tread on the feet of the passengers who are seated. In the old type of car the conductor was always troubled by passengers congregating at the back of the car or on his platform ready to alight as soon as the car pulled up. Their object was to be able to drop off without having to push through a crowd in the interior. Since the alteration, allowing passengers to alight at the front, the conductor always has a clear platform, while the car is more evenly loaded over both trucks, and rides much more smoothly. Instead of garden type seats the longitudinal seats have been substituted to facilitate the passage of people through the car.

In Fig. 5 a passenger is seen boarding the car at the conductor's end, there being sufficient room only for one to enter at the same time. In Fig. 6 the passenger is shown alighting from the driver's platform. Both entrance and exit are, of course, on the near side when the car is on the proper rails. The car has been in service since March 17, and appears to give the greatest satisfaction. One or two minor points have been noticed for inclusion in future alterations. An important result of the innovation is that at busy points there are no longer two streams of people engaged in rivalry to enter and leave the car at the same platform, thus causing uncomfortable crowding and delaying the car.

A HOME-MADE TOWER WAGON.

The general manager of the Northampton Corporation Tramways, Mr. John F. Cameron, has sent to us the accompanying photograph of a motor tower wagon which he recently equipped for the surprisingly small sum of £198 16s. Mr. Cameron remarks that "this machine shows what can be done in these days of difficulty and high prices, with a little scheming." The chassis is a Fiat of 16-24 H P., with disc clutch and four-speed and reverse gear box with gate change, which Mr. Cameron chanced upon in the yard of a certain London dealer. An examination indicated that the chassis was a good bargain, and Mr. Cameron drove the machine home to Northampton, making a non-stop run of over 70 miles. This was a good test for a beginning, and during the six months the chassis has been at work it has travelled many hundreds of miles without any trouble.

16-24 H.-P. Fiat Chassis Fitted with Tower Wagon.

TRAMCAR STRUCK BY ZEPPELIN BOMB.—During an air raid on a north-east coast town on Saturday, April 1, a bomb struck a tramcar. At that time all the cars were stationary, the traffic having been stopped immediately the alarm was given. A tramway inspector was killed and a woman conductor was seriously injured.

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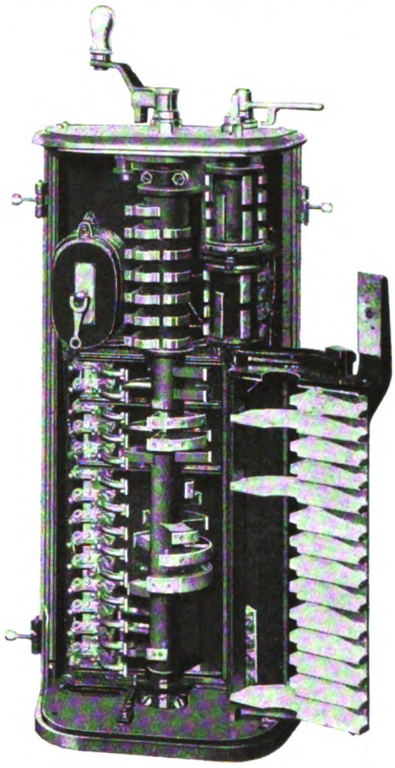
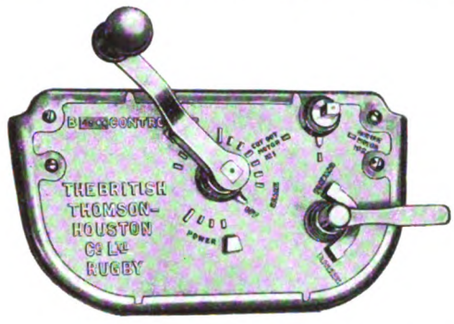
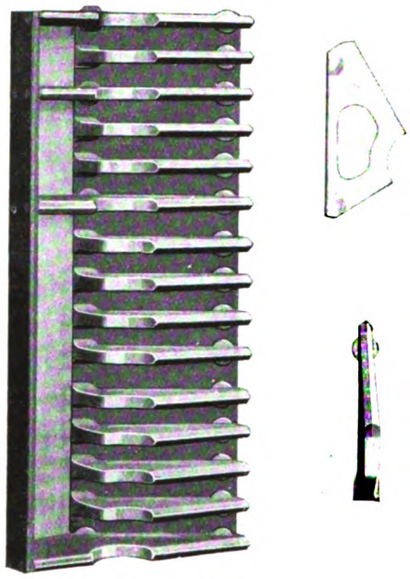
"RUN BACK PREVENTER" TRAMCAR CONTROLLER.

For tramway service a simple form of control apparatus is essential in order that a driver, in cases of emergency, may instinctively do the correct thing to avoid accident. Very reliable and simple forms of controllers have been in use for many years, but in one respect, viz., that relating to rheostatic braking in the event of a car running away backwards, considerable improvements are possible. Controllers of the braking type now in use are so placed that if the car is running in a forward direction, on moving the handle to the brake notches, currents are generated in the motors, producing a retarding torque, the direction of the currents in the motors being such as to strengthen the magnetism of the fields. If, however, the car is running backwards and the controller handle be moved to the brake notches, the direction of currents generated in the motors is such as to de-magnetise the fields so that no braking effect is produced.







B. T.-H. Controller with Rheostatic Braking for Forward and Backward Running.

To obtain a braking action when the car is running backwards, the British Thomson-Houston Company, Limited, of Rugby, have designed and manufactured controllers in which, when the controller handle is moved to the "off" position, connections are made which cause one or more of the motors to act as generators, producing the desired effect. These connections are such that no braking action is obtained during forward running of the car if the handle is in the "off" position. An arrangement preferable to this, however, is one in which the motion of the control handle which produces braking for forward running will also produce braking for backward running. The B49 controller shown in the illustrations will give this result. The reverse switch handle may be in either the forward or reverse position, when by moving the main control handle to the braking notches a rheostatic braking effect will be obtained for either forward or backward motion of the car. This controller is suitable for use with two 40-H.P. 500-600 volt series motors and it has four series, four parallel, and seven brake controlling points.

Another useful new feature of the B49 controller is the mechanism by which a defective motor may be cut out of service without removing the cover of the controller. This is a great safeguard in preventing delay in traffic, and avoids the necessity for the driver at any time to touch the internal mechanism. To cut out a motor it is only necessary to remove the reverse switch handle from its spindle and apply it to the cut-out spindle which projects through the cap plate, shown in the illustration near the back edge of the cap plate. This cut-out spindle has three running positions—a central position for which both motors are in circuit, and a position on each side to cut out either motor. An interlocking mechanism prevents the reverse switch being moved unless the cut-out switch spindle is in one of its three running positions. The usual interlocking mechanism is provided to prevent the reverse switch being moved unless the main cylinder is in the "off" position.

The arc deflector of the B49 controller, consisting of fireproof barriers, is of strong mechanical construction, the large deflector plates being supported at both ends, and the small plates moulded with large bosses for the fixing screws, thus providing rigid fixing for the plates.

A strong magnetic blow-out is provided for all fingers of the main cylinder on which arcing takes place, and an insulating trough surrounds the back half of the main cylinder protecting the frame from the influence of the arc or live parts. The trough is

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divided into sections by barriers; these, with the arc deflector which covers the front half of the main cylinder, form separate chambers for enclosing the various sections of the cylinder which may be at different potentials.

The brake cylinder is mounted on the main cylinder spindle in accordance with long-established standard British Thomson-Houston practice, thus preventing any possibility of change in the relative positions of brake cylinder and handle, which may occur due to wear on the gears or cams when the brake cylinder is mounted on a separate spindle.

One feature of this controller, not to be found on most tramcar controllers, is the provision of ample space for the incoming cables, and the arrangement of the various parts to enable wiring to be easily and quickly effected.

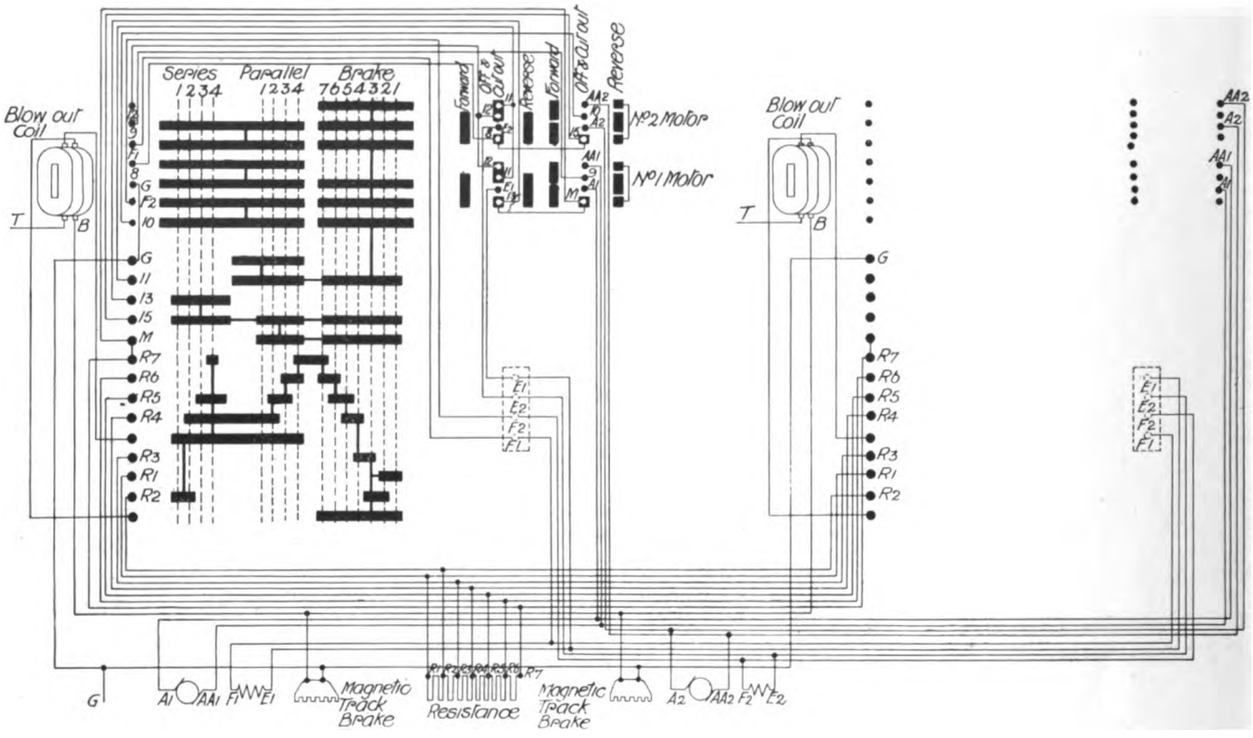

Diagram of the "Run Back Preventer" Controller and Car Wiring.

STREET TRAFFIC CASUALTIES IN 1915.

The extent to which decreased lighting and other war-time conditions have added to street traffic dangers is clearly indicated in the return of accidents issued on March 15 by the Home Office. It shows that during the twelve months to December 31 last 3,014 persons were killed and 60,189 injured by vehicles on public highways in the United Kingdom.

These figures, the highest yet recorded, give an average of over eight deaths and nearly 165 cases of injury per day. They compare as follows with previous returns :—

	Killed.	Injured.	Total.
1909	1,151	16,872	18,023
1910	1,327	29,750	31,077
1911	1,557	33,653	35,210
1912	1,764	36,833	38,597
1913	2,099	42,544	44,643
1914	2,330	59,340	61,670
1915	3,014	60,189	63,203

Mechanically-propelled vehicles were almost entirely responsible for last year's increase. They caused 614 more deaths and 4,597 more cases of injury than in 1914. Fatalities due to horse-drawn vehicles rose by 50, but on the other hand non-fatal accidents show a decrease of 1,150. Appended are the detailed figures for 1914 and 1915 :—

	1914.		1915.	
	Fatal.	Non-fatal.	Fatal.	Non-fatal.
Motor cars, motor vans, etc.	1,154	22,295	1,644	26,034
Motor omnibuses	222	3,667	239	3,263
Electric tramcars	153	7,110	260	8,372
Horse omnibuses	5	45	—	32
Horse-drawn tramcars ...	2	21	1	6
Other horse vehicles ...	626	13,190	682	12,068
Pedal cycles	168	13,012	188	10,414
Totals	2,330	59,340	3,014	60,189

Accidents in London.

In the Metropolitan Police district last year there were 847 fatal and 25,640 non-fatal accidents, and in the City 20 persons were killed and 1,229 injured. Of the deaths in the whole of the London area, including the City, 156 were caused by motor omnibuses, 439 by other motor vehicles, 87 by tramcars, 172 by horse-drawn vehicles (other than tramcars or omnibuses), and 13 by pedal cycles.

As many as 10,158 persons were injured by motor cars, motor vans, etc., 4,020 by electric tramcars, 2,786 by motor omnibuses, 5,482 by horse-drawn vehicles, and 4,423 by bicycles. Below is the record of fatal and non-fatal accidents in the Metropolitan Police district and the City for the last seven years :—

	Met. Police District.		City of London.	
	Fatal.	Non-fatal.	Fatal.	Non-fatal.
1909	287	11,731	16	1,354
1910	348	12,493	19	1,363
1911	385	13,849	25	1,405
1912	514	15,291	24	1,360
1913	579	18,365	17	1,210
1914	637	25,239	19	1,253
1915	847	25,640	20	1,229

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LONDON AND BOSTON TRAMWAY SUBWAYS.

The two illustrations given on this page show comparative views of the entrances to tramway subways in London and in Boston, U.S.A. The London view shows the northern entrance at Southampton Row, while the Boston picture illustrates a new incline in Boylston Street to take the place of an old incline in a public garden which has been filled. This picture is reproduced from one in the report of the Boston Transit Commission for the year ended June 30, 1915. Boylston Street has been widened to 120 ft., so as to provide space for the new incline in the middle of the street.

An island platform for street car passengers (as shown in the illustration) was constructed by the Boston Elevated Railway Company (which works the local electric lines—elevated, surface, and underground).

Tramway Subway from Southampton Row to Victoria Embankment.

Tramway Subway in Boylston Street, Boston.

The subways in Boston in which tramcars run are now very extensive, and the narrow streets in the centre of the town are thus relieved of much traffic.

The new incline in Boylston Street is part of an arrangement that has been carried out for connecting the Tremont Street subway with the Boylston Street subway. On these lines about 2,000 cars per day pass in each direction.

MINISTRY OF MUNITIONS CERTIFICATES.

Under the Munitions of War Act, 1915, the whole of the various Corporation and company tramway undertakings have been included in the Ministry of Munitions certificates, and are subject to very much the same regulations as a controlled establishment. Accompanying the certificate is a communication stating that for the purpose of carrying on the production of munitions it is of importance that good tramway facilities be maintained.

ONE-MAN CARS IN CANADA.

Superintendent McCaulay, of the Calgary Street Railways, believes that he can save the city at least one-third of the cost of working certain lines of its street railway system by running one-man cars, and the first car of this type is now being tried. The motorman acts both as motorman and conductor. Entry is made through the front of the car, and the back vestibule is set aside for a smoking compartment. A box for the fares is set immediately at the door. The *Electrical News*, of Toronto, states that several Canadian cities have announced their intention to try one-man cars. At Brandon, Manitoba, one-man cars have been working for two years, and are said by the municipal authorities to be running successfully, and at a much reduced cost as compared with the ordinary type of car. The cars are operated on the pay-as-you-enter system, and it has been found that the motorman can not only attend to his car, but see to the collection of fares and open and close the doors necessary.

DOUBLE INCOME TAX QUESTION.

By 86,060 votes to 6,000 recorded in a poll, a meeting of the shareholders of the Bombay Electric Supply and Tramways Company held on March 15, in London, decided to transfer the control of the company to Bombay. This course was taken in order to escape the double income tax payable in England, thus effecting a saving of £17,000. In addition to the income tax, the company was faced by the liability of being subjected to the excess profits tax, although the war had retarded its progressive earning capacity, according to the remarks of Sir Charles Ollivant, who presided at the meeting. He also stated that the Indian income tax scale had been raised. The directors had been advised that the transfer would not impair the legal status of the company as an English company. At a meeting of Indian shareholders held at Bombay, a similar decision was arrived at.

The question of double income tax affects Colonial tramway companies that have offices in London. The grievance was recently made the subject of a question to the Chancellor of the Excehquer, as reported in our issue of Feb. 10.

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THE
Tramway and Railway World

FOUNDED IN 1892 AND PUBLISHED BY
THE TRAMWAY AND RAILWAY WORLD PUBLISHING COMPANY, LIMITED,
AMBERLEY HOUSE, NORFOLK STREET, LONDON, W.C.

SUBSCRIPTION:

THE TRAMWAY AND RAILWAY WORLD can be obtained, post free, at the following rates:

FOR THE UNITED KINGDOM Twenty-five Shillings per annum

THE ANNUAL SUBSCRIPTION INCLUDES 64 ISSUES, OF WHICH 12 ARE ILLUSTRATED NUMBERS.

FOR ALL PLACES ABROAD Thirty Shillings per annum.

Single Copies One Shilling (Postage, 2 pence - Abroad, 5 pence).

THE EDITORIAL AND PUBLISHING OFFICES OF
THE TRAMWAY AND RAILWAY WORLD
ARE AT AMBERLEY HOUSE, NORFOLK STREET,
LONDON, W.C.

Telegraphic Address: "TRAMIGRO, LONDON."
Telephone No.: GERRARD 2048.

LONDON, APRIL 13, 1916.

Preventible Accidents.

The degree of efficiency of a passenger-carrying business is reflected in the number of accidents due to preventible causes. The greater the efficiency the fewer are the mishaps arising from circumstances that can be avoided. Under the trying conditions that have beset them during the past year managers have evidently not neglected the important task of providing instruction for the ever-changing personnel of the employees in the ways and means of preventing accidents. This year the managers' difficulties are likely to become greater as the months go by. The extreme restriction of street and car lighting has now been extended to the west coast, and passengers in various places are grumbling because of the dull and dismal hue given to the car lights. The lighting restrictions must, of course, be complied with; but in a number of towns, by the use of suitably designed shades, it has been found possible to give passengers a reasonable amount of light within the car. It is gratifying to record that the traction and lighting authorities in London are, within the limits allowed by the military commanders, making successful efforts to avert some of the accidents that occur at night. At busy points the light of the lofty incandescent electric and gas lamps has hitherto been practically blackened out. A new device is to fix two single lights at a height of about twenty feet up the standards, with a flat shade to prevent the light being thrown upwards, the globes being partly coloured. By the management of the County Council tramways a contribution is also being made to the safety of pedestrians at night. Intending passengers at badly-lighted stopping-places have had to incur risks from oncoming motor vehicles by going into the roadway in order to gain a close view of side destination boards or faintly illuminated route numbers and indicators. A new and efficient device gives a red colouring to the interior of the white crystals of the route numbers, rendering them more visible. A good example of British determination to increase the efficiency of their services is being shown by the Underground Railways and London General Omnibus Companies. Their operating manager has arranged a series of efficiency meetings at which various topics are made the subject of papers and discussions. One paper will be headed "'Safety First' Campaign: A Sound Proposition with an Unsound Title." It is immaterial whether the title can be subjected to criticism. The movement has been extensively taken up in the United States by railways and street car undertakings with excellent results. In this country the Great Western Railway have paid great attention to the matter in their magazine during the past three years, with the result that the movement has been initiated in one of the Australian States. In Glasgow it was initiated with vigour by the tramways department not long before the outbreak of the war, and there can never be a time more suitable than the present for London or any other place to follow suit. The London General Omnibus Company are recognising this by a vigorous advertising campaign in daily and local newspapers and by means of posters. One direction in which accidents may be prevented is shown by the running away and overturning of a car. This is not the first time that a car on the brink of a descent, and with the motorman absent from the platform, has been started by the conductor releasing the hand brake from the rear without making sure that the driver was at his post. There are several ways by which the possibility of such an accident can be averted, and the use

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of automatic electric control, which becomes possible on the introduction of electric traction in railway work, has appeared to guarantee the elimination in many important details of the human element or factor that has so often led to serious accidents from failure to carry out certain necessary acts. The most noticeable instance of this was the well-known "dead man's handle," which for some time has been regarded as a sure safeguard against sudden illness or accident to the driver on an electric locomotive where only one man is really necessary for control. But, just as the familiar saying has it, that one may easily drive a coach and four through any Act of Parliament, so it might now be feared (until technical skill renders impossible even this tampering with safety devices) that there is at least momentary danger from a direction not hitherto suspected.

A "Run-Back" Preventer. After a considerable interval tramway operators were a few days ago once more reminded of the lurking risk of cars running away backward downhill. A case of the sort occurred in London, and though no one was injured, the incident was sufficiently alarming, for the car left the rails at the foot of the hill and went through a fence into a field. However powerful brakes may be, there is always a chance of the power being reduced owing to slippery rails, or to failure of the human element in the moment of excitement or danger. In regard to the electric brake, it appears that in some forms of controllers it is only effective when the car is running forward, and is not available should the car by accident start to run down a hill backward. One form of device designed to overcome this trouble is illustrated in the present issue, and possesses the advantage that the electric brake is applied when the car is running backward by exactly the same movement as that required when it is running forward. That is to say, the driver has simply to move his controller handle over to the brake notches in the ordinary way. This is a much better arrangement than any which would require the driver in case of a run-back to do something which he never has to do in any other circumstances. It is important that in the moment of emergency the man can make effective use of a movement which through long use in the case of forward running has become practically automatic on his part. By the use of this new controller, when the handle is moved on to the brake notches, the current generated in the motors produces a retarding effect whether the car is going forward or backward.

A Failure of Electric Train Control. The recent fatal accident at the Crystal Palace tunnel on the Brighton Railway's electrified section has caused some anxiety as to the control of electric trains. In this case the driver of a train either fell or was dragged by a passing train from the window of his driving compartment, causing the train to overrun its next stopping-place, until the guard, suspecting something wrong, applied the brakes and pulled up the train. The accident points clearly to one of two possibilities—the "dead man's handle" failed in its object, and did not come into use after the accident occurred either through defective mechanism or from voluntary interference. The evidence at the inquest appears to show that the mechanism was in perfectly normal order, and that the current was full on when the guard applied the brakes. The discovery of a small wedge on the floor of the compartment close to the controller forcibly suggests therefore the second possibility of voluntary interference with the handle mechanism. This does not necessarily imply blame to the driver, except in so far as any such action would break the rules laid down for working. He may have been seized with momentary sickness, and considered it insufficient cause to stop the train; but whatever the reason he has himself suffered most of all. Such an occurrence, however, must not be again allowed, and although it is fortunate that electric working permitted immediate control of the train by the guard, who exercised most praiseworthy promptitude, neither the public nor the railway staff will rest contented until any such possibility of nullifying the automatic action for stopping the train at once in case the driver lets go the driving handle for any reason shall be altogether prevented. This should be quite easy to devise, and we have perfect confidence that it will be done at once, so that all the advantages of electric traction may be fully maintained.

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TRADE AFTER THE WAR.

In our issue of March 9, we referred to a number of public events and movements, with the object of showing that some progress was at length being made in awakening the nation to the necessity of special measures for the encouragement and protection of British trade after the war. Some further significant features—not all of them wholly favourable—have since emerged.

The Driving Force of Mr. Hughes.

Of these features of the situation the most hopeful and inspiring are the unequivocal views expressed in the forcible and eloquent speeches in this country of Mr. W. M. Hughes, the Prime Minister of Australia. His energy, vigour, and determination in preaching the gospel of immediate action for the purpose of preventing Germany again undermining British commercial influence within the Empire must prove of the greatest possible value. He has put fresh spirit and determination into our industrial and manufacturing world; he has advocated root and branch methods of dealing with the German trade octopus; he has pointed out how he and his Government have already dealt with it in Australia. The Australian metal industries, as well as all other business there, are already free once for all from the Teutonic shackles. So in regard to the Empire; his call is for systematic organisation of all our resources. "To wait until the end of the war is to play directly into the hands of our enemy." And, again—"This is our hour, our opportunity, which being let slip will pass for ever." We are to give the lead to our Allies, not merely to "wait and see" what they will propose. The trumpet call of Mr. Hughes has roused the country. It has spread uneasiness among the doctrinaire free traders, who in spite of the revolution in which they are living cannot shake off old shibboleths. It has caught the ear also of the free trade British workman, for is not Mr. Hughes a labour leader, the head of a Labour Government, a democrat of democrats? The one thing to pray for is that his counsel will be heeded by the British Government, and that he will be able to infuse into them some of his vigour and decision. In that way we may get rid of procrastination, indecision, and the remains of a worn-out system of one-sided free trade carried on for German benefit and for our own undoing.

The Allies' Economic Conference.

This leads us on to the Economic Conference of the Allies which is about to be held in Paris. It is certainly a step in the right direction that such a conference is to be held at all, but it is not encouraging to find Mr. Asquith quieting the fluttering dovecot of his Cobdenite supporters by assuring them that the British representatives at the conference will not commit the Government to any policy regarding Customs, and, indeed, it appears that these representatives will not discuss Customs questions. The indication is that there will be further conferences at which possibly the British Government will advance further. That is another instance of the evil policy of delay and "wait and see." Of course, the country should not be committed without the consent of Parliament, but what the country wants is a bold and determined policy for Empire protection and for conjoint protection among all the Allies against German trade machinations after the war. A sound policy of that kind would, unless we mistake the temper of the country, receive much support from a great majority of the House of Commons. In fact, it seems probable that if our timid hesitating Government are unable to lead, the country will dictate a policy and force the Government to act, as the country has already done since the war began.

It is regrettable that the new Budget does not point the way, as no departure is made from the old dangerous trade policy of *laissez faire*. With Mr. Bonar Law as one of the representatives at the Economic Conference there is, however, still room for hope that our allies may discover that not all the inhabitants of these islands are purblind and incapable of learning even from the bitterest experience.

Development of Research.

Passing from these general to what may be called departmental aspects of the subject, a very interesting report by the Advisory Council on the organisation and development of scientific and industrial research was published in the latter part of March. This body of experts (who include Lord Rayleigh and Sir Wm. McCormick) was appointed last July to advise a Committee of the Privy Council under a scheme of the Government, and the report is an interim one on initial work undertaken. One of the objects of the scheme is to make this country independent of Germany in industry and the materials for industry. The instituting and assisting of specific researches for the benefit of industries and of institutions for the purpose and the establishment of research scholarships are among the methods to be employed. To examine, select, combine, and co-ordinate, and to prevent overlapping are other important duties of the Council for which there is much need. Grants have already been made to a number of scientific and professional societies for the continuation of researches, the subjects including alloys, heating of buried electric cables, properties of insulating oil, laboratory and optical glass, tin and tungsten, corrosion of non-ferrous metals, tool steel, and hard porcelain. The Council have also appointed standing committees of experts in mining and metallurgy, the latter including Sir Robert Hadfield and Sir Gerard Muntz. Another committee is to be constituted for engineering, and a register of research is to be established.

A Glut of Committees.

It is evident that this Advisory Council has made a good beginning. But the danger which we see is that of over-lapping as between various agencies. For example, just after the issue of the report dealt with above, it was announced that a conference of representatives of the chief learned and technical societies of the country had resolved to establish a Conjoint Board of Scientific Societies for the purpose of organising scientific effort. One of the objects is to promote the application of science to industries. Obviously this Conjoint Board must work along with the Advisory Council already referred to, or there may be much over-lapping and confusion. About the same time the Board of Trade announced the appointment of committees to consider the position of certain important British industries after the war, especially in relation to international competition, and to report what measures are necessary or desirable in order to safeguard that position. The committees constituted are for the iron, steel, and engineering industries, and for the shipping and ship-building industries. More are to follow. Now, what is to be the relation of these committees to the Advisory Committee of the Board of Trade on Commercial Intelligence and its sub-committees? Is the work of all these bodies to be co-ordinated and also co-ordinated with the action of the Advisory Council? There must be some controlling and directing hand. Perhaps no better body can be found for the purpose than the Advisory Council. If any adequate benefit is to accrue there must be a co-ordinating authority for each important branch of work.

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LONDON TRAFFIC IN 1913.

To the Editor of THE TRAMWAY AND RAILWAY WORLD.

Sir,—In your issue of March 9 you published an article "From a Correspondent," many statements in which are evidently made without knowledge of the facts.

Increase in Passengers and Decrease in Earnings per Omnibus.

The decrease in receipts per omnibus as between 1911 and 1913 was mainly due to the development of the outer area of London, and not to the flooding of routes previously worked by the omnibuses, although the popularity of the omnibuses made additions to some of the services necessary. The number of omnibuses worked in 1911 was totally inadequate for public requirements, and the London General Omnibus Company was at that time actively engaged in the manufacture of additional vehicles to meet the growing demand.

The following is a comparative table of the average number of passengers per vehicle for the omnibuses and for the tramcars:—

	L.G.O.C.	*L.C.C.*
1911	268,000 ...	326,000
1913	208,000 ...	297,000
1914	243,000 ...	314,000

Account has only been taken, in the case of the L.C.C., of electric tramway passengers and vehicles, and, as the seating capacity of the tramcar is more than double that of an omnibus, the relative efficiency may be seen by doubling the omnibus passengers per vehicle.

It would appear that the L.C.C and not the L.G.O. is running an excess number of vehicles. The 1914 figures show how rapidly the number of passengers per vehicle increased.

Average Receipt per Passenger.

On an average, 20 per cent. of the routes worked by the L.G.O.C. run into districts outside the urban area. The average distance travelled over such routes is considerably in excess of the average for in-town routes, such as are worked by the L.C.C. Tramways.

We should, therefore, add 20 per cent. to the average earning per passenger on the L.C.C. Tramways, which will give a comparative figure of 1·21 for the L.G.O.C. The omnibus company also have not adopted return tickets to the same extent as the L.C.C. These, together with the workmen's tickets, account for the insignificant remaining difference of one-tenth of a penny.

"Omnibus Paradise."

Your correspondent falls into the common error of assuming that the centre of London is the omnibus company's gold mine, but where are facts in support of this? It is the greater popularity of the omnibus, which is free from the constant delays incidental to the tramways, that adds to the earning power of the omnibus. Omnibuses working on tramway routes are remunerative and are not supported by the greater earnings of other services suggested by your correspondent.

Relative Popularity of Omnibus and Tramcar.

If we call one passenger one vote, the L.G.O.C. is easily at the top of the poll.

Embankment Traffic.

With a complete scheme of motor omnibuses, which would be possible in the absence of the tramways, there would be no such scenes as are to be witnessed nightly on the Embankment. This traffic does not arise there, but is forced there. The congestion is created by the tramways; it would never have existed if motor-omnibus routes had been developed to deal with it. During the slack hours the omnibus is capable of dealing with the whole of the traffic to be moved—a vehicle with less than half the seating capacity of the tramcar, and this would appear to the ordinary observer to be an advantage to that means of transit.

There are districts to-day which depend entirely upon the omnibus for surface transport, and where the traffic is quite as heavy as that in districts served by the L.C.C. tramways.

Your correspondent pictures the result of omnibuses following tramway routes in all cases. Apparently it has not occurred to him that tramway routes are not necessarily the lines along which passengers desire to travel. They have to go where the means are provided. The omnibus has the advantage of being able to take them by the route they prefer.

Efficiency of the Motor Omnibus.

It has been proved by records which have been taken, and which it is open to anybody to take, that the efficiency of the motor omnibus, taking into consideration its relative seating capacity, is nearly double that of the tramcar.

The object of Sir Albert Stanley's paper would not appear to have been to state the case of the omnibus as against the tramway, but to explain the transit facilities of London as a whole, which are unique and not comparable with the transport facilities of the other large cities of the world.

London, *March*, 1916. "ANOTHER CORRESPONDENT."

THE WOMAN CONDUCTOR.

POSSIBILITY OF HER PERMANENT EMPLOYMENT.

BY A CORRESPONDENT.

Introduced as a temporary means of filling up the gaps caused by war service, the employment of women car conductors seems destined to have far-reaching effects upon tramway business and methods. Though no one would say that the conductors who enlisted at the nation's call should not be fully reinstated when they return home, it is already suggested that car-conducting may well be recognised as a proper sphere of labour for women. As the result of a recent visit to Glasgow, where the experiment has been most thoroughly tried, the writer can affirm that public opinion is veering steadily round in favour of the woman conductor. In a service so largely controlled by popularly-elected representatives, public opinion counts for a great deal.

The favour that the innovation has won is deserved. No one can travel in the cars conducted by women without becoming aware of an influence explainable only by the presence of a woman on the platform. The whole atmosphere of the car is pleasanter and freer than when a man is the conductor. To define the causes of the difference is to risk clumsy expression of delicate issues. Perhaps it is that chivalry on the part of male passengers, the kindness and fellowship of female car-users, and the soft persuasiveness of womanly authority, combine to produce an impression that somehow the car is self-conducted. Not only have the fears lest the woman conductor should be unable to keep order in the car proved groundless, but it almost seems as though the need for a conductor's authority had passed away. Remembering scenes of crowding and pushing in which the male conductor was a cause of irritation, and seeing how a crowd becomes almost self-controlled in the presence of the woman conductor, one realises that a higher phase of social order has come into the tramcar.

But human nature has not altered, and there is another side to the picture. The fact that passengers do not look to the woman conductor to maintain order is proof that she could not control them if they were disposed to be disorderly. The danger is not imaginary, and tramway managers would be wise to take it into account. For instance, if a certain kind of passenger believed he had only women to encounter, he would give free rein to his disorderly propensities, and it might therefore be necessary to organise some form of police on undertakings staffed by women conductors.

An important aspect of the subject is brought to view, however, by a remark recently overheard in a car. A male passenger said: "I never knew how hard a conductor's job was until I saw women at it." If the woman conductor is to become a permanent asset of tramway management, her ability to stand the work must be considered. To punch a tramway ticket does not call for much exertion, but to cancel sixty per hour for four hours at a stretch involves a considerable expenditure of physical energy. The mental concentration required for the selection of tickets proper to each passenger's destination, for collecting fares and giving correct change, the stopping and starting of the car, and all the numerous details of a conductor's duty, imposes a strain upon the nervous system that must be taken into account. The question therefore arises—Can women endure such a strain for a long period of years? It may be argued that conducting is a healthier occupation than many other employments of women. A reference to principles already in practice may throw some light on the problem.

In factory organisation it is a general rule that mechanical operations and processes that cannot be adjusted to individual capacities are entrusted to men only, and that machines readily adjustable to the ability of each worker may be operated by men or women. Some people have been astonished to find that a woman can operate a metal turning lathe, but in reality no machine tool responds more accurately to the capacity of the operator. Age or sex does not matter, if the worker can operate the machine to its fullest capacity. During the past thirty years, spinning machines and weaving looms have changed from male to female and female to male labour in a manner quite bewildering to the outside observer. When the self-actor spinning mule was made automatic and easily controlled, it fell into the hands of women operatives; when the large double frames were introduced, mule-spinning mostly reverted to male workers. In manufacturing departments where the machinery grinds relentlessly on and cannot be stopped or modified without loss or disorganisation, male labour is employed almost exclusively.

Apply the foregoing principles to the working of tramways. Each car is a unit in a system, and it must be kept going or the whole system will be disorganised. It is said that car-conducting is a healthier occupation for women than dressmaking or machine sewing, and we agree. But a customer can be asked to wait for her dress because the finisher has fallen ill at her work, and a machinist who faints in the factory disturbs only a very little the course of operations. Great inconvenience, however, would result if a woman conductor fainted on her car in a busy street. At the present time, the woman conductor is reinforced by the impulse of novelty in herself and the large tolerance of a public willing to submit to much

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under war conditions. In course of years those supports will draw away, and the full effects of weariness in the conductor and the need for efficient service will become manifest.

It would be easy to sketch a gloomy picture of the future of the woman conductor, but that is not the intention. The arguments adduced are not conceived in a spirit of hostility to the woman conductor. On the contrary, the writer believes that if the methods of operation in tramways were adjusted to her capability, both she and the tramway authorities would enter on a permanent relation mutually profitable and highly advantageous to the public. Methods of fare collecting, distribution and checking of tickets, regulation of traffic, the facilities for entrance and exit of passengers, hours of duty, and other factors, will require readjustment if the services of women are to be fully utilised on the rear platform. In short, the woman conductor, so accidentally introduced, promises to be a most important factor in tramway operation.

"SAFETY FIRST" CAMPAIGN FOR LONDON.

The March assembly of the series of Operating Department Efficiency Meetings was held at the L.G.O.C. Training School, Milman's Street, Chelsea, when a paper on "Safety First—A Sound Proposition with an Unsound Title"—was given by Mr. Percy Lane, of the claims department. There was an attendance of about 120 operating officers, invitations upon this occasion having been extended also to the tramways connected with the London and Suburban Traction Group, whose claims work, together with that of the Underground Railways and the omnibus company, is now all handled by the one department.

Mr. H. E. Blain, the operating manager, presided, and amongst those present were Messrs. J. F. Thomas (general superintendent), H. Lansdown (assistant general superintendent), Captain Rozier (superintendent of employment), S. Smith (ticket superintendent), of the London General Omnibus Company Limited; Messrs. W. E. Blake (superintendent of the line), S. J. Webb (passenger agent), of the railways; Messrs. H. Dawson, R. Johnston, Newman, Lamprell, of the claims department; Messrs. A. H. Pott, of the London United and Metropolitan Electric Tramways; W. E. Hammond, of the Metropolitan Electric Tramways; A. V. Mason, of the South Metropolitan Tramways; and J. B. Mackinnon, of the London United Tramways. The paper was preceded by an exhibition of the L.G.O.C. training film, which has special bearing upon the prevention of accidents.

Mr. Lane referred to the origination of the safety campaign in America under the stimulus of the annual award of a gold medal by the family of the late Anthony Bradey, a well-known street railway man, to the American electric railway company that was considered most praiseworthy in its efforts in regard to the safety of the public and its employees. The medal was first awarded in 1914, and was secured by the Boston Elevated Railway Company, which had commenced a safety campaign in 1909. The Boston training system was briefly described, and some interesting particulars were given as to the publicity methods adopted by that company. These included a contest for money prizes amongst the school children, who were also circularised with a "Safety" brochure. Two electrically illuminated exhibition cars bearing announcements of the campaign were run over the system for a month, and, in addition to public circulars, letters were sent to the residences of all the employees directing attention to the safety campaign, whilst placards and signs were largely exhibited in the city and distributed to stores, etc. About £1,500 was expended on the campaign, and it was claimed that there was a reduction of 25 per cent. in the number of accidents. Local safety committees were appointed representing the various branches of the service, suggestion books kept at all depots, and no effort was spared to enlist the sympathies of both the public and the staff. Twenty-two American transit companies had used cinematograph films for this work, six for public use, eight in connection with the education of school children, and eight in the training of the staff.

In Great Britain the safety movement was inaugurated by the Great Western Railway in August, 1913, when a series of articles was commenced in the monthly staff magazine, the phrase "Is It Safe?" being utilised as the most suitable one. In 1914, the Great Western Railway officially recognised the movement, and reprinted the articles in brochure form, distributing a copy to each of the 80,000 members of the staff. The monthly article is still continued in the magazine, and it is intended to extend the movement into all departments of the railway work. The Great Western Railway safety brochure is very freely illustrated with photographs showing the type of accident to be avoided, and has been adopted by other railway companies for distribution to their respective staffs. This railway company has also instituted first aid classes, paying the doctors' fees for their lectures, and bearing the whole expenses of the medical appliances and outfit. The London and South Western Railway have published a safety brochure similar to that of the Great Western Railway, the illustrations being adapted to the rolling stock, etc., of their railway, and a supplementary chapter added illustrating the dangers of the live rail.

Both the Glasgow Corporation Tramways and the London General Omnibus Company had, immediately prior to the outbreak of war, intended to proceed with a safety campaign, but the operations of both had been suspended, and it was now intended, so far as the London transit companies connected with the Underground group were concerned, to press on with the campaign. The paper went on to describe the methods of training adopted on the Underground Railways, the London General Omnibus Company, the Metropolitan Electric Tramways, the London United Tramways, and the South Metropolitan Tramways, and there were exhibited on the screen some exceedingly interesting and instructive charts, showing in a comparative form the percentage of accidents under different headings which occurred on the four different Underground Railways, and again in connection with the omnibus company as compared with the three tramway companies. These showed very clearly the marked influence on the number of accidents of attention paid to training methods and the inculcation of safety tenets, the omnibus accidents having decreased by no less than 44 per cent. during the last two years, despite the increased dangers of darkened streets and other war conditions.

The safety campaign would include:—Crisp warning advertisements in the public Press, the exhibition of striking notices on the staircases of the public vehicles, the issue of special "safety" pamphlets addressed to children, to cyclists, to pedestrians, etc., the use of cinematograph films, etc.

Both the paper and the subsequent discussion were of a practical character, the speakers including Messrs. Mackinnon, Hammond, Mason, Thomas, Blake, Dawson, Johnston, and Newman. The staff were invited to forward suggestions, and a considerable number have responded.

All the company's omnibuses now display a "safety" advertisement, and the first of the "safety" pamphlets has been issued, whilst a number of the Press advertisements have also been published.

The next efficiency meeting will consider a paper on "The Graphic Presentation of Operating Data."

OMNIBUSES AND ROAD UPKEEP.

No Legislation During the War.

In the House of Commons on March 30, Mr. Anderson asked the President of the Local Government Board whether he was aware that in 1913 the motor omnibuses of London ran 105,000,000 miles; that this traffic caused much damage to the highways; and that the engineer to the Middlesex County Council estimated that the cost of repairing a particular road was increased by such traffic to the extent of 2d. per omnibus mile; whether, in view of the conditions of motor omnibus competition with the London municipal tramways in that the latter had to lay, maintain, repair, and pay rates upon their tracks, whereas the omnibus had the free use of the roads, the Government would introduce a Bill to enable municipal authorities to control street traffic and to levy a roadway maintenance charge upon motor omnibus traffic. Mr. Hayes Fisher (Parliamentary Secretary to the Local Government Board): The President of the Local Government Board feared it would be quite impossible for the Government to introduce legislation on this subject at the present time.

The statement that the Birmingham Motor Omnibus Company had arranged to run a service of motor omnibuses into Lichfield on the same conditions as to road maintenance, etc., as prevailed in the districts affected by the Walsall Corporation Act, is not correct. While the licences were offered on those conditions, the company have not taken them up, nor do they intend to do so.

In a report presented to Walsall Town Council on March 13, the Works Committee stated that the Road Board could not see their way at the present time to make a grant towards the cost of resurfacing Stafford Road, Bloxwich, which had been worn out by the Tramways Committee's motor omnibuses. The Tramways Committee therefore had been asked to pay an amount corresponding with the sum they had agreed to pay to the County Council for the adaptation of roads in the latter's area for motor omnibus traffic, together with a contribution of $\frac{3}{8}$d. per omnibus mile in respect of the cost of maintaining the road. Alderman Cope, chairman of the Tramways Committee, suggested that the matter should be deferred until the point at issue had been settled by Parliament. The Tramways Committee would agree that any decision arrived at by Parliament should be retrospective. This suggestion was agreed to.

Lancaster Corporation are making application to the Local Government Board for permission to borrow £10,000 for the purchase of omnibuses to be run by the tramways department. The Lancashire County Council's Roads and Bridges Committee have recommended that the County Council enter into an agreement with the Corporation for the latter to maintain all the main roads in the borough for a period of five years from April 1, 1916, on the same terms as the existing agreement, subject to the condition that the omnibuses be limited to six, and be prohibited from being used outside the borough boundaries.

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FINANCIAL REPORTS AND MEETINGS.

Dick, Kerr and Company, Limited, have paid an interim dividend at the rate of 6 per cent. per annum on the preference shares.

Melbourne Tramway and Omnibus Company.—The board announce a dividend of 6d. per share for the quarter ended March 31, and also a bonus of 1s. per share.

Hastings and District Electric Tramways Company.—As the result of the past year's working £1,000 is placed to depreciation, £1,500 to suspense account, and £766 carried forward, after paying 6 per cent. dividend on the preference shares.

Five per Cent. Railway Debenture.—The North British Railway Company is the first British railway to make an issue of debenture capital bearing 5 per cent. interest. The loan will be redeemable at par in three, four, or five years at the holder's option, and the issue will be in sums of £200 and upwards.

North Ormesby, South Bank, Normanby, and Grangetown Railless Traction Company.—Mr. W. W. Storr, who presided at the annual meeting at Middlesbrough, on March 13, said the paid-up capital was £21,678. The cost of the Act (including the Middlesbrough Corporation opposition) was £4,012, while buildings and overhead equipment absorbed £14,139, and land and sundries £2,755, a total of £20,906. If the cars could be delivered they would be able to start running any day. Mr. T. Edwards was re-elected a director.

Madras Electric Tramways Company.—The profits for 1915 were £22,498, and £3,258 was brought forward. After providing for debenture interest and other charges, and adding £6,000 to the renewal fund, the divisible balance is £14,289. A dividend of 6 per cent. is proposed on ordinary shares, writing £581 off issue expenses, and carrying forward £4,272, subject to excess profits duty. Traffic receipts show an increase of 6·4 per cent. Special renewals of the permanent way having been completed, the reduced sum of £6,000 has been credited to depreciation and renewal fund.

Stewarts and Lloyds, Limited.—After making provision for estimated contingencies under the Munitions of War and Finance Acts, the board recommend a dividend of 2s. and a bonus of 6d. per share on the deferred shares for the past year, placing £60,000 to general reserve, and £20,000 to employees' benefit reserve, and carrying forward about £100,000. Similar distributions (12½ per cent.) were made on the deferred shares for each of the two previous years, £60,000 being reserved, and £97,666 carried forward twelve months ago, and £70,000 and £95,371 respectively at the end of 1913.

The British Westinghouse Company.—The report for the year ended December 31, 1915, shows that the net profit amounted to £176,752, and, including the balance brought forward of £8,121, there is a total of £184,873. This sum has been appropriated as follows:—Amount written off patents, goodwill, etc., £25,000; special depreciation of plant, machinery, etc., £35,241; additional reserve for employers' liability, £5,000; dividend of 7½ per cent. on preference shares, £75,000; carrying forward £44,632. Having regard to the possible liabilities for taxation of excess profits under the Finance and Munitions of War Acts, the directors have carried forward a larger sum than usual. The company was declared to be a controlled establishment under the Munitions of War Act, 1915.

Hadfields, Limited.—The directors recommend for the past half-year a final dividend of 2s. and a bonus of 2s. per share, tax free, making 5s. per share (25 per cent.) for the year. The distribution amounted to 22½ per cent. for 1914, 20 per cent. for each of the two preceding years, and 17½ per cent. for 1911. Sir Robert Hadfield, who presided at the annual meeting on March 27, said that Parliament had taken care of the nation's interests so far as armament business was concerned. All the firms would cheerfully pay their quota. The taxation was just and fair, but that armament firms should be attacked, notwithstanding the fact that they had been the saviours of the Empire, was most unjust, and not at all like the usual fair-minded manner of the Press. He did not understand why the Prime Minister seemed so lukewarm towards the deputation which asked the appointment of a Minister of Commerce.

The Lancashire United Tramways, Limited.—At the ordinary general meeting held at Winchester House, London, the Hon. Arthur Stanley, M.P. (chairman), in moving the adoption of the accounts for 1915, referred to the satisfactory result of the working, notwithstanding the increase in expenditure caused mainly by the extra cost of materials, war bonuses, and amounts paid to dependents of men who have joined His Majesty's Forces. 130 men are serving with the colours, but the usual service of cars had been maintained through the employment of female labour, which was proving satisfactory. Since the early days of the war the staff and employees of the company had made a regular monthly contribution to the funds of the British Red Cross Society. These contributions averaged over £25 per month, and amounted to over £360. Mr. Stanley (who is chairman of the Joint War Committee of the British Red Cross Society and the Order of St. John of Jerusalem in England) thanked all who had thus generously helped.

Underground Electric Railways of London.—Lord George Hamilton, who presided at the annual meeting on March 10, referred to the agreement between the London Electric Railways and the London General Omnibus Company for the creation of a pool of certain receipts, and for giving through traffic and bookings without apportioning the through fares. Each of the railway companies showed substantial improvements in their earnings for last year, and, although the operating costs had increased, the margin available for dividends was larger, and each company was consequently able to pay larger dividends. The London General Omnibus Company showed a falling off in revenue and a decrease in working expenses, owing to the War Office having taken a number of omnibuses for war service. The total income of the Underground Electric was £680,741, or a decrease of £3,884. The balance from the last account amounted to £38,441, making £719,182. After meeting the various charges there was £38,575 to be carried forward. Replying to a suggestion by Sir R. Perks that fares should be raised by an average of a farthing, the chairman stated that such a policy would encourage competition, for they had not got a monopoly of traffic.

London and Suburban Traction Company.—In moving the adoption of the report at the annual meeting on March 15, the Rt. Hon. C. B. Stuart-Wortley, K.C., M.P. (chairman), said that during the year the 5 per cent. debenture stock had been reduced by £9,317 to £338,683. They had also reduced the amounts of loans owed by them to subsidiary companies and by subsidiaries to them. The income had increased by £3,851 to £122,430, and the net sum available for expenses and dividends was £125,316, against £127,176. The final result was £83,641 available for dividends, against £92,224 in the year 1914. Five per cent. had been paid on the preference stock, absorbing £80,158, leaving £3,482 to be carried forward. The absence of any dividend on the ordinary stock brought home the fact that the country was at war. The company was not an operating enterprise, but was a holding company. Coal by rail had gone up by 13 per cent., sea-borne coal 34 per cent., timber 50 per cent., glass 90 per cent., copper 50 per cent., wood blocks 31 per cent., and steel tires 20 per cent. All the subsidiary companies were interested in some of those commodities and some were interested in all. In some cases prices were still rising. The three companies that supplied light and power sold 42·3 millions of units, against 39·6 millions in 1914. The three tramway companies showed a reduction in car miles run to an extent sufficient to increase the sum received per passenger in the face of a decrease in passengers. Not the least satisfactory feature was the all-round improvement of the reserves. The undistributed profits of the seven companies were £41,582 (£118,812, against £77,230) better in 1915 than in 1914, and had that sum been distributed in dividends it would have given 2 per cent. on the ordinary stock of the London and Suburban Traction Company. Mr. W. M. Acworth seconded the motion, which was agreed to.

Remarkable Year at Leeds.—A statement issued on April 3 by Mr. J. B. Hamilton, general manager, Leeds Corporation Tramways, shows that the receipts for the year ended March 31 were £41,150 in excess of those for the year 1914-15, although the car-miles had decreased by 117,616, or 1·23 per cent. Owing to the large number of motormen and conductors who have joined the forces, the department were unable to utilise fully the stock of cars. In the number of passengers there was an increase of 7,814,533. The extension of the tramways in the Wharfedale district added 17,000 to the population served by the tramways. Appended is a comparative table:—

	Year ended March 31, 1916.	Year ended March 31, 1915.	Increase + Decrease −
Receipts	£475,661	£434,510	£41,150/11 + (9·47% +)
Miles run	9,405,121	9,522,737	117,616 − (1·23% −)
Passengers	103,453,801	95,639,266	7,814,533 + (8·14% +)
Receipts per mile	12·138d.	10·951d.	1·187d. +
Average fare paid per passenger	1·080d.	1·075d.	(10·84% +)
Population served	542,000	525,000	17,000 + (3·23% +)
Times population carried...	191	182	9 + (4·94% +)
Amount paid per head of population	17 2	16 4	10d. + (5·10% +)

Metropolitan Electric Tramways.—The report for the year ended December 31, 1915, shows that the revenue amounted to £513,561. After adding the balance brought forward and deducting all expenses chargeable to revenue, including £22,715, for reconstruction and renewals, there remains £14,275 which the directors propose to appropriate as follows:—Reserve account, £13,000; dividend on preference shares, £25,000; 1 per cent. dividend on the ordinary shares, £4,743; carried forward, £1,532. The strike of employees in May last caused an almost entire stoppage of the services for 13 days, including the Whitsuntide holidays. The loss in receipts amounted to £16,000. The wages bill for the present year will show a material increase owing to further concessions granted to the staff in December last. The mileage open is 56·25, and the company

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have 312 cars. The number of passengers was 89,656,054, as compared with 93,325,170 in the previous year, and the car miles amounted to 9,686,525, as compared with 11,479,592. The average receipts per passenger were slightly higher at 1·23d. Mr. E. Garcke presided at the annual meeting on March 13. In moving the adoption of the report, he said the service was reduced during the greater part of the year owing to the shortage of men caused by employees joining the forces, and also owing to the strike in May last. In the autumn the police permitted the employment of women as conductors. More than 150 were now employed, and it was probable that that number would be largely increased. The 13 days' strike caused a loss of £10,300 in receipts. For the whole year the traffic receipts had been very good, notwithstanding a reduction of over 15 per cent. in car mileage. The total expenses, including payments to local authorities, repairs, and maintenance, and interest were £470,400, or about £24,000 less than in 1914. This reduction went a long way towards neutralising the falling off in the receipts of £18,000.

Leicester Corporation Tramways.—The following is a summary of the report for the year ended December 31, 1915, with a comparison of the results of the two previous years:—

	1915.	1914.	1913.
Traffic revenue	£159,678	£149,664	£147,458
Other revenue	28,842	20,571	17,059
Total	188,520	170,235	164,517
Working expenses	122,142	118,607	110,115
	66,378	51,628	54,402
Add bank interest	355	—	416
Reserve fund interest ...	—	1,660	3,346
Gross balance	£66,733	£153,288	£58,164
Interest on mortgages, etc.	26,229	24,010	23,541
Redemption of debt ...	16,647	13,765	12,453
Income-tax	4,484	2,801	2,122
Bank interest	—	207	—
War allowance, reservists, etc.	7,412	1,284	—
Net balance	11,961	11,221	20,048
	£66,733	£53,288	£58,164

Other statistical information given in the report is as follows:—

	1915.	1914.	1913.
Units per car mile	1·97	1·82	1·77
Power cost per car mile ...	1·927d.	1·469d.	1·431d.
Traffic receipts per track mile	£4,202	£4,045	£3,985
Traffic receipts per car mile	9,827d.	8·682d.	8·758d.
Expenses per car mile ...	7·516d.	6·880d.	6·560d.
Ratio of expenses to revenue	65%	69%	66%
Total track mileage	37	37	37
Number of cars in stock ...	160	160	150

Mr. A. F. Lucas, general manager, attributes the increase in receipts to the exceptionally good trade of the town and to increased fares. The number of passengers was 40,440,158, an increase of 2,525,385, and the cars ran 3,899,939 miles, a decrease of 237,323. The total receipts averaged 11·601d. per mile, against 9·875d. last year, an increase of 1·726d. From October 27 to December 31, 1915, 67 women were trained as conductors, and these are doing their work satisfactorily. Mr. T. R. Smith, the engineer, reports that the new machinery installed at the Lero power-station has worked in a very satisfactory manner, throughout the year, and has undoubtedly contributed to a reduction in the working costs; but the increased price of fuel has had an adverse influence on the generating costs. It will be necessary to renew a considerable length of trolley-wire during the present year. Four canopy tops were fitted to open-top cars at a cost of £360 10s. 6d., and further tops are being provided as other cars come in for roof repairs.

BRISTOL TRAMWAYS AND CARRIAGE COMPANY.

Sir George White, Bart., presiding at the ordinary meeting on March 21, moved the adoption of the report recommending that a final dividend at the rate of 6 per cent. per annum for the half-year be declared, that £20,000 be carried to the reserve fund for contingencies and renewals, and that the balance of £5,055 be carried to the next account. For the first time in the company's history, remarked the chairman, the gross revenue exceeded half a million sterling. During the year the tramways receipts increased by £8,703, or 3·63 per cent., and the carriage department by £49,017, or 23·39 per cent. In 1908 the tramways receipts were 82 per cent. and the carriage receipts 18 per cent., while for 1915 the percentages were 49 and 51. Largely as the result of extensions to Westbury and Filton and of the feeding of these and many other tramway routes by motor omnibus services, the tramways receipts improved from £213,104 in 1908 to £248,355 in 1915. The carriage department receipts in 1908 were £47,615, and in 1915 £258,529. In 1909 the reserve fund was £204,994, while it now stood at £286,438. These evidences of development indicated that they had a property which, under enterprising management, was capable of continuous expansion, for, upon what he suggested were sound principles, *pari passu* with the extraordinary increase in the carriage department, they had the fact that whereas in 1909 the reserve fund stood at £204,994, it was to-day £286,438, an increase of £81,444. Notwithstanding too that in that period they wrote off their investments £18,762 for depreciation in market values, an experience shared by most companies possessing investments. The dividend for 1908 was 6 per cent. whereas it was only 5 per cent. for the past year, but if, as he had no reason to doubt, the carriage departments and manufacturing business continue to develop, he thought that in the matter of dividend they would also progress. The receipts were £248,355 from tramways department, £258,530 from carriage department, and £5,500 from sundry receipts, giving a total of £512,385—an increase of £57,611. On the expenditure side, traffic expenses figured for £175,415, an increase of £793 only, general expenses were £75,916, an increase of £16,969, accounted for by an increase in rates and taxes (principally in income tax) of £9,163 and in the allowances to dependents of their men at the war of £8,300. Renewals, repairs, and maintenance were £162,189, an increase of £23,574, accounted for by the additional £21,831 written off motor vehicles and manufacturing plant and £2,700 extra on electrical. The total expenditure was £413,520, an increase of £41,335, against an increased revenue of £57,610; and the net profit £98,864, an increase of £16,275. The items for interest, preference dividends, and interim dividend absorbed £61,184. The number of passengers on the cars and omnibuses was 60,272,400, an increase of 1,970,815. The Avonmouth omnibus receipts had risen from £12,500 in 1914 to £17,000, and he did not know what that district would have done without those facilities. The company's businesses in Bath, Gloucester, Weston-super-Mare, Cheltenham, and Tewkesbury were quite successful, and they were only deterred from introducing new services in Bristol and elsewhere owing to the depletion of the staff by the war. In conclusion, the chairman made a long reference to the negotiations by the Corporation for the purchase of the tramways, and submitted the correspondence between the Option Committee of the Corporation and the directors. The company's desire to meet the Corporation in a reasonable spirit had only added fuel to the fire of the ardent municipalisers. The committee gave the directors short shrift when, after months of wearisome correspondence, they put matters to the test by offering substantial rearrangements of fares on every route, coupled with the privilege of all-day return tickets for the workers, half-fares for school children, etc. These concessions would have resulted in the saving of many thousands of pounds every year to the travelling public, and therefore seemed to the directors an ample set-off against the idea that purchase was a necessity to the securing of a readjustment of fares. The Option Committee made the following demands:—

(1) To rearrange the existing ordinary fares and stages so as to give an average ride of two miles for a penny, three miles for three-halfpence, four miles for twopence, five miles for twopence-halfpenny, with suitable overlapping stages, the exact position of the stage points to be agreed. (2) To grant half-fares to children up to 15 years of age, but no fare to be less than a halfpenny. (3) To undertake to run efficient services of cars on all routes to the reasonable satisfaction of the Corporation, subject in case of difference to an appeal to the Board of Trade. (4) To keep the rolling stock and plant in a high state of efficiency and to adopt such improvements from time to time as may reasonably be required by the Corporation, subject in case of difference to an appeal to the Board of Trade. (5) To provide (at the joint expense of the Corporation and the company) combined waiting rooms and public conveniences at suitable points on the tramway system as may be fixed by the Corporation. (6) To pay a wayleave rent in the form of an annual sum per street mile of tramways for three periods of seven years.

The directors replied that the suggested revolution in fares would sweep away the whole of the ordinary dividend and impinge upon the preference dividend. To suggest a way out of the impasse the board stated that as the Treasury would refuse to allow the issue of a loan they would be prepared to facilitate the purchase of the tramways undertaking by accepting three-fourths or the whole of the purchase price in Corporation stock at ½ per cent. more interest than the then market yield of Government stock. That offer had not been accepted. If the Corporation would make up their minds quickly, the directors were still willing to meet them in any possible manner so as to do business.—The report was adopted, and on the motion of Mr. H. R. Smith, the meeting decided that the remuneration of the directors, other than the managing director, be £2,200 per annum, as from May 1 last, free of income tax. In seconding the foregoing, Dr. C. A. Hayman remarked that the sum mentioned was the original fee the directors received, and some years ago it was reduced. Since the war began the shares had risen 60 per cent. Mr. J. H. Howell, who was re-elected a director, said the great success of the company was due to Sir Geo. White's energy and power of organisation. He had also at once seen the possibilities of the internal combustion engine. The possibilities of the carriage department were practically limitless. In reply to a vote of thanks, the chairman said that though the directors worked continuously, the fact must not be overlooked that the company had employees devoted to the interests of the concern. From the managing director and Mr. Challenger downwards they had worked hard.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls. Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Other.	Total.
Aberdeen ..	*May 31, 1915	Dec., 1899	E.	27 56	415,000	366,332	48,668	366,332	13,225	184,118	234,194	189,803	86,614	1,388	88,002
Accrington ..	*Mar. 31, 1915	Aug., 1907	,,	10 53	181,925	144,570	37,355	144,570	13,729	106,831	37,739	16,891	27,510	340	27,850
Ashton-u-Lyne.	*Mar. 25, 1915	Aug., 1902	,,	8 15	130,070	111,376	18,694	111,376	13,599	66,708	36,236	3,200	22,577	343	22,920
Ayr	*May 15, 1915	Sept., 1901	,,	9 30	128,000	98,630	29,369	100,705	10,742	78,770	27,866	17,649	17,181	804	17,985
Birmingham .	*Mar. 31, 1915	Jan., 1904	,,	118 71	2,858,935	2,437,104	421,831	2,472,938	20,801	1,940,158	496,946	176,726	640,091	6,923	647,014
Blackburn ..	*Mar. 25, 1915	Mar., 1899	,,	24 63	408,174	342,474	65,700	336,258	13,566	354,600	191,985	3,718	65,158	3,144	68,302
Blackpool ..	*Mar. 31, 1915	June, 1899	,,	(p)21 51	460,473	316,005	144,468	316,005	14,604	316,005	138,577	19,698	75,344	761	76,105
Bolton	*Mar. 31, 1915	Dec., 1899	,,	47 69	551,092	551,092	Nil	570,981	11,930	348,111	202,980	43,059	140,182	1,228	141,410
Bradford ..	*Mar. 31, 1915	July, 1898	,,	(h)118 9	1,280,788	1,043,788	237,000	1,043,054	8,831	634,618	439,321	75,208	309,320	20,568	329,888
Brighton	*Mar. 31, 1915	Nov., 1901	,,	17 15	378,093	279,978	98,115	280,392	16,314	211,268	69,124	7,562	54,413	2,113	56,526
Burnley	*Mar. 31, 1915	Dec., 1901	,,	22 18	388,052	326,077	61,975	232,580	10,465	170,852	72,664	29,550	77,161	1,306	78,467
Burton-on-Trent	*Mar. 31, 1915	Aug., 1903	,,	10 50	108,632	104,562	4,070	106,275	10,121	47,788	56,784	10,134	15,223	1,510	16,733
Bury	*Mar. 31, 1915	June, 1903	,,	(b)36 10	407,800	284,745	123,055	293,237	12,826	254,832	55,416	33,960	68,740	276	69,016
Chester	*Mar. 25, 1915	April, 1903	,,	6 35	92,991	82,380	10,611	82,934	12,883	66,977	16,059	5,072	12,935	317	13,252
Chesterfield ..	Mar. 31, 1914	Dec., 1904	,,	5 8	98,000	73,500	24,500	69,810	13,663	57,660	13,820	6,307	13,608	465	14,073
Colchester ..	*Mar. 31, 1915	July, 1904	,,	7 75	70,748	69,555	1,193	69,471	8,736	48,360	22,007	Nil.	13,413	380	13,793
Croydon	*Mar. 31, 1915	(q) Sept., 1901	,,	17 50	287,689	287,689	Nil	286,765	16,271	222,223	107,039	41,643	87,833	781	88,614
Darlington ..	*Mar. 31, 1915	June, 1904	,,	8 71	107,500	77,889	29,611	8,748	77,870	55,236	25,881	7,369	13,451	261	13,712
Darwen	*Mar. 31, 1915	Oct., 1900	,,	7 13	93,400	86,300	7,100	87,199	12,174	51,200	33,555	9,396	14,645	988	15,633
Derby	*Mar. 31, 1915	July, 1904	,,	22 27	...	...	...	248,373	11,113	...	74,267	(r)38,410	51,903	978	52,881
Doncaster ..	Mar. 31, 1914	June, 1902	,,	12 58	...	...	...	107,921	8,481	94,700	16,581	1,442	22,890	318	23,208
Dundee	*May 15, 1915	July, 1900	,,	28 32	(f)	362,789	...	371,145	13,068	266,027	96,762	92,694	66,320	1,954	68,274
East Ham ..	*Mar. 31, 1915	June, 1901	,,	14 16	192,270	191,016	254	196,309	13,824	129,336	78,806	...	59,552	680	60,232
Exeter	*Mar. 31, 1915	April, 1905	,,	7 0	106,000	88,818	17,182	88,818	12,688	67,966	21,360	6,420	17,964	55	18,019
Gloucester ...	*Mar 31, 1915	April, 1904	,,	15 1	191,000	144,333	46,667	147,783	9,846	104,965	22,901	1,000	16,693	1,114	17,807
Halifax	*Mar. 31, 1915	June, 1898	,,	55 39	449,263	417,466	31,797	420,185	7,570	283,249	129,670	36,442	111,792	1,378	113,170
Ilford	*Mar. 31, 1915	Mar., 1903	,,	12 49	152,883	152,883	Nil	149,574	11,859	102,839	50,043	3,239	31,539	442	31,981
Ilkeston	Mar. 31, 1914	May, 1903	,,	3 56	64,214	47,000	17,214	47,833	13,436	31,462	16,422	...	6,915	171	7,086
Ipswich	*Mar. 31, 1915	Nov., 1903	,,	14 70	116,471	114,300	2,171	115,676	7,776	94,894	115,549	15,940	22,796	493	23,289
Keighley	*Mar. 31, 1915	Oct., 1904	,,	6 9	50,934	47,711	3,223	...	...	26,936	20,774	...	8,957	296	9,253
Kilmarnock ..	*May 15, 1915	Dec., 1904	,,	5 47	65,000	52,795	12,205	52,801	9,450	46,450	10,078	6,618	8,416	201	8,617
Kirkcaldy ...	*May 15, 1915	Feb., 1903	,,	8 65	213,000	97,868	115,132	97,868	11,105	76,466	21,402	5,223	16,564	412	16,976
Lancaster ...	*Mar. 31, 1915	Jan., 1903	,,	4 65	...	45,700	...	43,711	9,083	28,750	17,669	3,342	5,534	159	5,693
Leith	*May 15, 1915	Aug., 1905	,,	17 73	275,000	238,000	37,000	237,983	13,286	171,500	66,070	6,604	36,298	1,086	37,384
Leyton	*Mar. 31, 1915	Dec., 1906	,,	8 76	325,084	324,445	639	296,209	16,741	232,345	92,304	2,740	72,983	1,409	74,392
Lincoln	*Mar. 31, 1915	Nov., 1905	S.	2 77	98,519	44,947	53,572	44,987	15,185	40,226	12,529	(t) 692	6,435	117	6,552
Liverpool ...	Dec. 31, 1914	Nov., 1898	E.	124 0	2,622,786	2,057,850	564,936	2,062,391	16,741	1,168,685	1,177,949	366,545	684,026	13,050	697,076
Lowestoft ...	Sep. 30, 1914	July, 1903	,,	4 6	96,230	91,178	5,052	91,178	22,375	75,480	17,614	Nil	11,357	373	11,730
Maidstone ...	*Mar. 31, 1915	July, 1904	,,	7 3	82,932	82,932	Nil	79,398	11,282	63,598	19,334	...	10,402	602	11,004
Manchester ..	*Mar. 31, 1915	June, 1901	,,	203 31	2,361,038	2,207,215	153,823	2,216,009	10,895	1,648,183	548,499	438,497	887,763	14,112	901,875
Nelson	*Mar. 31, 1915	Feb., 1903	,,	3 69	38,000	37,885	115	37,885	9,808	28,086	9,799	...	9,300	52	9,352
Newport (Mon.).	*Mar. 31, 1915	April, 1903	,,	14 28	232,500	196,250	36,250	196,184	13,671	155,216	49,868	3,479	41,752	952	42,704
Nottingham ...	*Mar. 31, 1915	Jan., 1901	,,	44 20	...	...	...	733,674	16,586	473,999	261,364	56,626	176,289	3,026	179,315
Oldham	*Mar. 25, 1915	May, 1902	,,	28 32 (b) 8 31	506,723	446,347	60,376	453,655	15,981	303,738	166,268	2,222	111,679	2,135	113,814
Perth	May 15, 1914	Nov., 1913	,,	6 75	90,000	78,350	11,650	78,629	11,334	...	...	...	8,944	928	9,872
Plymouth ...	Mar. 31, 1914	Sept., 1899	,,	15 0	182,856	181,479	1,377	219,417	14,628	86,903	89,493	24,252	39,989	891	40,880
Pontypridd ...	*Mar. 31, 1915	Mar., 1905	,,	8 50	137,847	137,839	8	138,568	17,321	107,403	30,436	Nil	22,819	427	23,246
Rawtenstall ...	*Mar. 31, 1915	May, 1909	,,	15 71	193,290	182,172	11,118	182,276	11,709	150,324	31,848	3,051	24,460	1,076	25,536
Rochdale	*Mar. 31, 1915	May, 1902	,,	(i) 40 2	356,991	347,782	9,209	353,200	15,407	347,782	108,034	16,000	77,660	5,742	83,402
Rotherham ...	*Mar. 31, 1915	Jan., 1903	,,	12 2	342,200	188,326	153,874	184,178	15,316	150,485	39,473	21,771	43,834	59	43,893
			R.T	...	...	...	...	...	...	...	...	...	...	...	...
Salford	*Mar. 31, 1915	Oct., 1901	E.	75 64	1,086,472	723,717	362,755	725,485	9,571	511,853	282,115	30,058	257,935	42	257,977
Southampton ...	*Mar. 31, 1915	Jan., 1900	,,	18 54	280,452	260,699	19,753	259,834	13,913	158,729	99,470	14,251	68,042	2,996	71,038
Southend-on-Sea	Mar. 31, 1913	July, 1901	,,	11 49	130,000	129,961	39	143,808	12,384	116,940	12,784	3,045	34,453	465	34,918
Southport ..	*Mar. 31, 1915	July, 1900	,,	(d) 10 63	292,000	197,730	94,270	196,178	8,424	67,250	57,870	442	19,970	450	20,420
South Shields ...	*Mar. 31, 1915	Mar., 1906	,,	10 21	251,882	184,056	67,826	181,097	17,646	155,214	37,314	30,837	39,275	570	39,845
Staly'ge, H., M., D.	*Mar 31, 1915	May, 1904	,,	27 57	325,270	280,990	44,280	279,778	10,096	209,387	71,603	1,211	37,490	130	37,620
Stockport ...	*Mar. 31, 1915	Aug., 1901	,,	27 5	318,847	234,500	84,347	265,014	9,789	155,686	92,313	37,776	(u)65,533	1,203	66,736
Sunderland ...	*Mar. 31, 1915	Aug., 1900	,,	20 28	308,699	303,211	5,488	306,766	15,074	161,996	132,265	45,044	75,229	386	75,615
Swindon	Mar. 31, 1914	Sept., 1904	,,	4 42	...	...	...	44,216	9,771	33,861	11,738	7,237	8,602	309	8,911
Wallasey ...	*Mar. 31, 1915	Mar., 1902	,,	19 77	208,867	195,290	13,577	222,027	11,122	159,306	72,879	10,612	63,690	815	64,505
Walsall	Dec. 31, 1914	Dec., 1902	,,	19 44	188,145	188,100	45	182,926	9,357	154,044	63,649	34,960	33,311	778	34,089
Walthamstow ...	*Mar 31, 1915	June, 1905	,,	13 30	198,000	194,000	4,000	190,477	14,251	168,248	25,249	...	41,346	443	41,789
Warrington ...	*Mar. 31, 1915	April, 1902	,,	9 52	103,674	102,896	778	102,128	10,583	67,028	35,869	7,977	22,631	261	22,892
West Ham ...	*Mar. 31, 1915	Feb., 1904	,,	30 4	578,478	551,588	26,890	556,878	18,532	469,051	123,888	26,236	147,703	4,509	152,212
West Hartlepool	*Mar. 31, 1915	Feb., 1904	,,	8 63	85,491	80,330	5,164	81,731	9,301	76,501	3,682	4,614	19,011	494	19,505
Wigan	*Mar. 31, 1915	April, 1901	,,	30 73	502,513	491,007	11,506	481,577	15,579	382,490	157,287	5,034	75,270	2,107	77,377
Wolverhampton	*Mar. 31, 1915	April, 1902	S.	21 40	279,733	268,185	11,548	292,361	13,596	209,497	71,812	53,987	54,593	730	55,323
Yarmouth (Gt.).	*Mar. 31, 1915	June, 1902	E.	14 58	149,600	124,750	24,850	126,453	8,588	115,700	29,148	9,613	21,872	494	22,366
York	*Mar. 31, 1915	Jan., 1910	,,	12 20	157,150	...	...	163,884	...	151,039	8,596	6,456	29,589	538	30,127

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	*Mar. 31, 1915	Nov., 1905	E.	98 54	1,528,146	1,381,200	136,946	1,455,506	14,702	1,343,000	257,730	96,622	266,249	3,988	270,237
Bexley	Mar. 31, 1914	Oct., 1903	,,	6 42	100,798	98,812	1,986	98,408	15,376	75,408	23,403	942	14,698	1,649	16,346
Birkenhead ..	*Mar. 31, 1915	Feb., 1901	,,	24 7	378,973	373,290	5,683	373,545	15,548	228,391	143,241	23,062	65,100	685	65,785
Bournemouth ...	*Mar. 31, 1915	July, 1902	,,	(e) 32 67	...	...	...	467,073	18,379	291,667	168,818	17,769	101,882	464	102,346
Cardiff	*Mar. 31, 1915	May, 1902	,,	31 66	832,356	787,292	45,064	811,043	25,484	485,049	302,242	98,778	139,256	36,785	176,041
Coventry ...	*Mar. 31, 1915	Jan., 1912	,,	15 61	251,014	238,355	12,659	238,803	15,151	229,235	14,363	4,095	44,633	771	45,404
Glasgow	*May 31, 1915	Oct., 1898	,,	198 10 (b) 2 53	4,564,266	3,694,143	870,123	3,751,708	19,127	2,411,868	1,282,275	2,326,543	1,070,694	6,184	1,076,878
Huddersfield ...	*Mar. 31, 1915	Feb., 1901	,,	56 4	772,662	467,142	305,520	477,919	8,526	281,927	194,599	7,522	124,200	2,859	127,059
Hull	*Mar. 31, 1915	July, 1899	,,	33 12	662,074	594,626	67,448	596,092	17,982	579,628	183,392	147,663	161,750	1,280	163,030
Leeds	*Mar. 31, 1915	Aug., 1897	,,	115 71	1,907,865	1,814,758	93,107	1,678,844	14,487	1,400,687	590,421	4,961	429,902	4,038	433,940
Leicester... ...	Dec. 31, 1914	May, 1904	,,	37 0	1,006,946	818,073	138,290	828,953	22,404	674,936	147,944	91,843	149,664	20,571	170,235
London	*Mar. 31, 1915	...	H.	9 67	...	...	...	...	...	...	...	...	10,261	540	10,801
		May, 1903	C.E	274 35	(c)	(c)	(c)	13,744,806	...	9,836,187	3,786,403	565,095	2,323,130	65,916	2,389,046
N'castle-on-Tyne	*Mar. 31, 1915	Dec., 1901	E.	62 72	1,597,129	1,309,200	287,929	1,332,133	21,178	905,066	524,407	74,656	280,147	13,117	293,264
Northampton ...	*Mar. 31, 1915	July, 1904	,,	12 37	239,800	147,255	92,545	173,019	13,883	118,932	48,610	14,628	30,775	534	31,309
Portsmouth ...	*Mar. 31, 1915	Sep., 1901	,,	34 48	708,619	708,619	Nil	731,174	21,132	423,103	285,516	81,715	121,909	2,082	123,991
Preston	Mar. 31, 1914	June, 1904	,,	17 16	224,102	187,269	36,833	187,269	10,888	117,315	47,130	39,392	45,618	328	45,946
Reading	*Mar. 31, 1915	July, 1903	,,	13 14	235,000	234,000	1,000	237,102	17,996	155,419	75,406	19,471	35,608	1,074	36,682
Sheffield	*Mar. 25, 1915	Sep., 1899	,,	79 8	1,782,471	1,484,400	298,071	1,558,246	19,703	1,122,482	512,567	34,450	391,535	2,996	394,531
Wellington, N.Z.	Mar. 31, 1914	...	,,	31 55	496,423	496,423	...	628,151	19,821	496,423	46,836	120,191	157,096	1,161	158,257

C—Electric conduit system. E—Electric trolley system. H—Horse lines RT—Railless trolley system. S—Surface contact system.
(a) Includes £1,441 trackless. (b) Includes leased lines. (c) Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed.
(d) Not including 12 miles 40 chains leased lines. (e) Includes 7 miles 34 chains leased lines. (f) Unlimited. (h) Includes 9 miles 26 chains railless trolley routes.
(i) 17 mi. 8chs. single track leased. (l) Including Insurance. (p) Including leased lines. (q) Corporation working commenced June, 1906. (r) Including £5,744 Accident Reserve.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Working Expenses. Traffic.	General.	Repairs & Maintenance.	Power.	Total.	Gross Profit on Working.	Additions to Gross Profit.	Deductions from Gross Profit. Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	Net Surplus + or Deficit −
Aberdeen	23,291	12,148	7,920	8,166	51,525	36,477	...	4,789	5,179	...	13,840	(i) 1,669	25,477	+ 11,000
Accrington	7,213	(i)2 849	2,116	4,261	16,439	11,411	...	3,997	3,877	358	568	598	9,398	+ 2,013
Ashton-und'r-Lyne	5,215	(i)1,919	2,874	3,470	13,478	9,442	...	2,300	3,965	776	250	...	7,291	+ 2,151
Ayr	4,682	(i)2,301	1,434	2,504	10,981	7,004	...	2,487	2,310	...	...	...	7,004	...
Birmingham	187,946	(i)86,491	86,067	113,375	473,879	173,135	5,558	71,965	58,402	...	...	730	131,097	+ 47,596
Blackburn	16,859	6,197	14,451	9,421	46,928	21,374	287	(h) 4,388	15,450	251	1,572	...	21,661	...
Blackpool	17,632	(i 7,755	9,239	10,225	44,851	31,254	...	(h) 9,878	7,640	...	...	...	17,518	+ 13,736
Bolton	50,044	(q) 9,486	15,912	20,689	76,131	65,279	857	(h)10,525	17,520	1,713	18,339	(i)981	49,078	+ 17,058
Bradford	91,597	(i)36,890	64,670	52,938	246,095	83,793	4,525	22,087	24,164	5,422	7,832	4,203	63,708	+ 24,610
Brighton	14,152	(i) 6,759	13,690	8,384	42,985	13,541	55	7,661	5,917	...	...	...	13,578	+ 18
Burnley	21,142	(i)10,079	9,141	17,955	58,317	20,150	...	6,796	8,284	1,515	...	(f)1,890	18,486	+ 1,664
Burton-on-Trent	5,609	(i) 1,821	2,686	3,086	13,202	3,531	24	1,266	1,451	...	...	...	2,717	+ 838
Bury	16,129	4,971	7,162	7,504	35,766	33,250	303	(h) 7,037	6,026	825	2,472	(w)11,193	27,553	+ 6,000
Chester	3,304	(i)1,834	1,318	2,256	8,712	4,540	130	(h)2,748	1,018	...	904	...	4,670	...
Chesterfield	3,214	1,368	2,936	2,192	9,710	4,363	269	2,275	1,900	...	...	...	4,175	+ 457
Colchester	3,045	1,372	2,370	2,783	9,570	4,223	28	(h) 1,986	2,496	...	...	(i) 172	4,654	− 403
Croydon	31,319	(i 9,151	14,128	17,684	72,282	16,332	749	7,889	7,415	1,587	...	...	16,891	+ 190
Darlington	4,273	896	1,895	2,103	9,167	4,545	160	1,926	2,006	101	1,202	...	5,235	− 630
Darwen	4,064	1,146	3,260	2,653	11,123	4,510	222	2,221	2,190	...	1,050	...	5,461	− 729
Derby	18,514	(i) 3,502	6,926	8,941	37,883	14,998	199	6,152	3,568	§ 12	5,432	(l) 141	15,305	− 108
Doncaster	4,969	1,342	6,550	4,166	17,027	6,181	16	2,935	1,840	138	572	58	5,543	+ 654
Dundee	17,829	(i)7,398	7,445	10,686	43,358	24,916	...	8,990	6,700	323	7,842	...	23,855	+ 1,061
East Ham	19,381	6,796	14,558	10,884	51,619	8,613	...	5,279	6,858	...	...	...	12,137	− 3,524
Exeter	4,793	1,535	1,715	3,556	11,599	6,420	...	(h) 2,241	1,950	120	...	...	4,311	+ 2,109
Gloucester	7,250	1,643	2,975	1,836	13,704	4,103	...	(h)5,362	1,881	370	...	...	7,613	− 3,510
Halifax	30,501	7,877	13,529	21,597	73,504	39,321	345	10,424	12,106	...	(y)925	(i)2,632	23,455	+ 16,211
Ilford	10,444	3,518	4,171	5,387	23,520	8,461	557	3,786	5,252	...	...	...	9,038	− 20
Ilkeston	2,262	789	1,378	1,460	5,889	1,197	160	1,450	1,532	90	...	96	3,168	− 1,811
Ipswich	8,801	1,962	5,033	3,494	19,290	3,999	(u) 4,877	(h) 3,660	2,207	...	3,421	(i) 237	9,525	− 649
Keighley	3,129	729	1,210	1,676	6,744	2,509	190	935	1,876	...	...	...	2,811	− 112
Kilmarnock	2,995	(i)801	1,434	1,636	6,866	1,751	5	(h)1,863	1,110	...	1,160	...	4,133	− 2,377
Kirkcaldy	4,811	1,416	2,312	2,912	11,451	5,525	68	2,604	2,411	...	409	136	5,560	+ 33
Lancaster	2,207	(i)617	879	1,615	5,318	375	52	942	1,250	...	...	...	2,192	− 1,765
Leith	9,979	3,455	5,148	4,215	22,797	14,587	2,264	(h) 6,029	7,850	...	3,252	150	17,281	− 430
Leyton	23,074	10,711	14,202	13,152	61,139	13,253	...	17,968	37	...	...	...	18,005	− 4,752¶
Lincoln	1,446	656	967	872	3,941	2,611	47	1,529	1,071	...	...	(i) 6	2,606	+ 52
Liverpool	192,352	69,830	83,100	123,527	468,809	228,267	25,231	50,082	63,726	...	(d) 34,821	(e) 4,869	153,498	+ 100,000
Lowestoft	3,405	655	1,552	2,323	7,935	3,795	...	2,441	2,251	...	...	...	4,692	− 897
Maidstone	2,584	1,152	2,052	1,771	7,559	3,445	56	2,473	1,976	...	...	...	4,449	− 948
Manchester	273,002	(i)117,573	85,280	128,350	604,205	297,670	14,615	(h)58,243	57,599	13,790	48,584	(e)34,069	212,285	+ 100,000
Nelson	2,390	798	1,717	1,982	6,887	2,465	...	958	1,059	...	...	314	2,331	+ 134
Newport (Mon.)	10,429	4,234	9,655	6,638	30,956	11,748	857	5,694	4,357	...	1,886	(i) 668	12,605	...
Nottingham	48,272	14,674	17,408	30,692	111,046	68,269	...	16,444	21,121	...	...	(i) 2,040	39,605	+ 28,664
Oldham	27,159	10,158	28,025	19,742	85,084	28,730	1,639	16,158	11,734	2,347	...	(g) 5,799	36,038	− 5,669
Perth	...	...	...	...	6,002	3,870	...	...	...	...	...	...	...	...
Plymouth	8,430	3,896	4,514	8,026	24,866	16,014	1,257	4,282	3,141	690	5,121	...	13,234	+ 4,037
Pontypridd	5,194	1,363	6,831	3,291	16,670	6,575	...	3,761	3,791	...	‖ 665	252	8,469	− 1,899
Rawtenstall	6,126	2,446	3,187	4,273	16,032	9,504	85	5,483	6,493	...	...	...	11,976	− 2,387
Rochdale	19,303	5,063	10,984	11,537	46,892	36,510	1,636	11,478	9,594	2,038	...	(i)(x)10,752	33,862	+ 4,284
Rotherham	E 11,039 RT ...	4,071	5,864	8,718	29,692	14,201	195	5,349	3,465	...	4,082	...	12,896	+ 1,500
Salford	75,579	(i)24,562	27,778	48,819	176,748	81,229	4,477	15,791	668	4,112	492	(k)29,378	51,441	+ 34,265
Southampton	21,466	(i) 6,862	9,433	12,545	50,306	20,732	(t)6,757	7,564	7,557	952	5,000	...	21,073	+ 6,416
Southend-on-Sea	8,046	2,260	3,534	6,187	20,027	14,891	4,228	(k) 3,834	1,753	...	4,017	...	9,605	+ 9,514
Southport	4,922	(i)2,406	2,765	3,015	13,108	7,312	6,249	6,549	5,018	...	2,120	...	13,687	− 126
South Shields	9,249	(i)5,225	4,156	6,880	25,510	14,335	140	5,230	3,651	...	...	...	8,881	+ 5,594
Staly'dge,H., M., D.	12,818	(i) 5,022	7,448	5,761	32,049	5,571	...	7,485	7,786	...	400	397	16,068	− 10,497
Stockport	15,630	5,817	10,718	4,683	36,848	29,886	2,260	5,240	10,008	1,586	3,134	2,790	22,758	+ 9,837
Sunderland	19,807	5,608	4,867	11,267	41,549	34,066	265	(h) 6,464	10,374	1,218	10,875	400	29,331	+ 5,000
Swindon	2,854	828	1,534	1,850	7,066	1,845	45	1,215	1,422	...	...	...	2,637	− 747
Wallasey	18,736	(i) 6,704	6,213	10,801	42,454	22,051	1,249	5,520	5,072	...	...	634	11,226	+ 12,074
Walsall	8,510	3,326	4,315	5,670	21,821	12,268	1,339	4,962	3,975	551	640	...	10,128	+ 3,479
Walthamstow	14,417	2,972	8,845	8,546	34,780	7,009	30	(h) 6,427	3,468	...	...	(i) 712	10,607	− 3,568
Warrington	6,135	(i)2,556	2,996	3,323	15,010	7,882	481	2,418	3,447	...	...	...	5,865	+ 2,498
West Ham	52,659	+14,531	33,326	19,420	119,936	32,276	243	18,875	12,679	...	692	...	32,246	+ 273
West Hartlepool	4,791	1,586	2,956	2,241	11,574	7,931	3	2,569	1,847	...	...	(f) 500	4,916	+ 3,018
Wigan	17,340	5,252	12,768	10,817	46,177	31,200	331	(h)13,866	13,101	...	...	3,662	30,629	+ 902
Wolverhampton	13,031	(i) 6,239	8,594	7,202	35,066	20,257	(x) 2,535	7,760	5,669	203	5,416	...	19,048	+ 3,744
Yarmouth (Gt.)	7,397	(i)1,989	2,833	4,441	16,660	5,706	40	(h) 4,158	2,883	...	...	...	7,041	− 1,295
York	9,958	(i)2,908	2,785	6,004	21,655	8,472	...	(h)5,176	2,084	...	...	...	7,260	+ 1,212

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	75,752	17,245	35,294	28,622	156,913	113,325	...	48,342	31,277	1,478	17,879	2,164	101,140	+ 12,185
Bexley	3,282	1,382	*3,554	828	(s) 11,630	4,716	...	2,794	2,509	...	324	...	5,627	− 911
Birkenhead	15,923	(i)5,621	12,124	5,839	39,507	26,278	...	(h)11,340	9,760	527	3,500	151	25,278	+ 1,000
Bournemouth	22,933	7,998	9,095	15,040	55,066	47,280	955	(h)10,587	16,535	...	...	(i)12,166	39,288	+ 8,947
Cardiff	43,914	11,332	26,879	26,593	108,718	67,323	1,123	23,925	22,645	2,272	6,947	2,655	58,444	+ 10,002
Coventry	13,626	4,333	9,005	3,564	30,528	14,876	137	8,521	5,755	...	...	(i)634	14,910	+ 103
Glasgow	345,625	(i)193,837	144,530	51,995	735,987	340,891	65,826	78,797	105,492	22,790	172,310	14,377	393,766	+ 12,951
Huddersfield	33,571	(i)7,911	20,449	12,047	73,978	53,081	...	(h)12,536	13,061	2,274	15,575	1,235	44,681	+ 8,400
Hull	(i)58,137	12,634	31,909	11,622	114,302	48,728	...	16,578	13,883	576	3,117	...	34,154	+ 14,574
Leeds	115,601	40,347	43,609	28,577	228,134	205,805	7,837	47,174	57,773	7,356	11,928	(i)7,844	132,075	+ 81,567
Leicester	59,052	11,397	22,836	25,322	118,607	51,628	1,660	24,218	13,764	2,801	10,741	1,284	52,808	+ 480
London	H. 4,737 E.793,481	1,859 (r) 276,574	3,878 364,064	(m) 5,854 250,124	16,328 1,684,243	def. 5,527 704,803	... 47,425	330,301	405,605	32,102	1,541	(l)15,851	785,400	− 33,172
N'castle-on-Tyne	79,328	25,580	31,120	24,430	160,458	132,806	3,197	(h)29,574	43,356	5,411	68	(i)13,837	92,246	+ 43,757
Northampton	8,428	3,187	3,103	6,136	20,854	10,455	473	(h) 3,900	4,624	441	90	(ib)1,221	10,276	+ 652
Portsmouth	31,414	(i)13,293	8,371	5,580	58,658	65,333	(a)11,483	21,643	18,455	1,941	11,677	532	54,248	+ 22,568
Preston	12,350	4,989	9,252	2,995	29,586	16,360	...	3,625	5,038	...	...	1,356	10,019	+ 6,341
Reading	8,324	(i)4,356	4,313	3,643	20,654	16,028	11	6,709	5,062	263	...	...	12,034	+ 4,005
Sheffield	120,296	(i)31,784	45,385	49,365	246,830	147,701	2,056	31,747	42,504	5,567	30,017	8,014	117,849	+ 31,908
Wellington, N.Z.	57,973	7,775	21,918	17,947	105,613	52,644	2,091	19,865	4,757	...	14,682	...	39,304	+ 15,431

(a) Includes £10,703 balance forward from previous year. (b) Includes £152 loss on omnibus account less profit on parcel service. (c) Includes £1,611 insurance fund. (d) Includes reserve. (e) Includes rents for leased lines. (f) Rent of leased lines. (g) Rent of lines and deficit on motor omnibus account. (h) Including income tax. (i) Includes Army Service Allowance. (j) Includes £692 deficit on railless traction. (k) Includes rents of lines. (l) Including loss on horse traction. (m) Horsing expenses. (n) Transferred to motor omnibus capital account. (o) Includes £1,837 through-running contributions. (p) Includes £407 horse account. (q) Includes National Insurance. (r) Including special charges. (s) Includes £2,584 through-running contributions to L.C.C. (t) Includes balance forward from previous year. (u) From borough fund. (w) Amount apportioned to leased lines. (x) Includes £1,554 profit on motor char-a-banc. (y) Parliamentary Expenses. (z) Includes £6,519 rent of leased lines. * Includes £1,913 spent on renewals. † Under a resolution of the Council, the allowances to employees serving with the Forces, amounting to £6,031, are defrayed out of rates and therefore not included in these accounts. ‡ £2,950 profit from 3 months' working. § Composition for Stamp Duty. ‖ Mortgage Loans. ¶ Included in this amount is £1,912 8s. 0d. paid to men on Active Service.

COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus.			Receipts per Car Mile.		Operating Expenses per Car Mile.					Percentage of Operating Expenses to Total Revenue.	Average Operating Expenses per Car Mile (excludi'g Power Costs).	Board of Trade Units.		
	Carried Forward.	Reserve.	Contribution to Rates or Municip'l Funds.	Average Total per Car Mile. d.	Average Traffic per Car Mile. d.	Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. (Price paid) d.	Total. d.	%	d.	Units.	Cost per Unit. d.	Units used per car mile.
Aberdeen ...	...	7,590	3,410	11·06	10·89	2·93	1·53	·99	1·03	6·48	58·54	5·45	2,317,204	·845	1·027
Accrington ...	...	...	2,013	12·20	12·08	3·16	1·24	·93	1·87	7·20	59	5·33	831,933	1·23	1·51
Ashton-u-Lyne	41	...	2,110	11·529	11·356	2·623	(c) ·965	1·446	1·745	6·779	58·80	5·034	659,302	1·128	1·382
Ayr...	...	...	...	9·61	9·16	2·50	1·25	·79	1·33	5·87	63	4·47	442,969	1·28	·98
Birmingham ...	30,000	17,596	...	10·910	10·793	3·169	1·459	1·451	1·912	7·991	73	6.079	24,185,574	1·125	1·7
Blackburn ...	...	...	...	13·81	13·71	3·40	1·25	2·92	1·91	9·48	68·70	7·57	1,739,274	1·3	1·84
Blackpool ...	...	1,736	12,000	16·82	16·65	3·90	1·71	2·04	2·26	9·91	58·93	7·65	1,552,635	1·58	1·43
Bolton	58	...	17,000	11·758	11·656	2·498	·788	1·323	1·721	6·330	53·836	4·610	4,514,010	1·1	1·56
Bradford... ...	...	14,610	10,000	12·425	11·816	3·457	1·041	2·450	2·027	8·975	74·60	6·948	12,272,121	1	1·926
Brighton... ...	18	...	...	12·240	11·782	3·064	1·464	2·964	1·816	9·308	72·79	7·10	1,676,770	1·2	1·51
Burnley	...	...	1,664	11·450	11·259	3·085	1·108	1·334	2·620	8·147	71·16	5·53	3,621,567	1·15	2·20
Burton-on-Trent	838	...	...	9·13	8·30	3·06	·99	1·47	1·68	7·20	78·5	5·28	530,080	1·39	1·04
Bury	...	(k)1,000	5,000	10·26	10·22	2·399	·776	1·253	1·268	5·696	51·82	4·428	2,045,692	1·25	1·26
Chester	...	...	...	9·16	8·94	2·28	1·27	·92	1·56	6·03	66	4·39	414,118	1·33	1·19
Chesterfield ...	...	457	...	11·1	10·8	2·54	1·08	2·31	1·73	7·66	68·9	5·93	420,824	1·25	1·38
Colchester ...	...	...	...	9·942	9·668	2·194	·989	1·709	2·006	6·898	69·24	4·892	445,214	1·5	1·34
Croydon	...	190	...	7·593	7·526	2·683	·784	1·211	1·516	6·194	78·68	4·493	3,000,308	1·416	1·071
Darlington ...	...	...	...	8·487	8·326	2·645	·554	1·172	1·304	5·675	66·85	4·371	504,546	1	1·301
Darwen	...	...	...	14·02	13·13	3·65	1·03	2·93	2·38	9·99	71·15	7·61	485,033	1·312	1·812
Derby	...	...	...	10·233	10·426	3·650	·691	1·365	1·763	7·469	71·6	5·706	1,479,947	1·45	1·216
Doncaster ...	...	654	...	10·52	10·37	2·24	·61	2·97	1·90	7·72	73·1	5·82	799,965	1·25	1·51
Dundee	...	61	1,000	11·802	11·465	3·082	1·278	1·288	1·847	7·495	63·5	5·648	2,564,659	1	1·847
East Ham ...	...	...	...	9·05	8·95	2·91	1·02	2·19	1·63	7·75	85·70	6·12	2,461,677	1·062	1·84
Exeter	...	2,109	...	9·629	9·60	2·560	·821	·917	1·900	6·198	64·37	4·298	615,956	1·375	1·38
Gloucester ...	...	...	...	6·84	6·41	2·78	·63	1·14	·71	5·26	77	4·55	470,336	1	·70
Halifax	...	(r) 7,483	(s)6,171	11·657	11·514	3·141	·812	1·393	2·225	7·571	65	5·35	4,607,293	1·125	1·98
Ilford	...	...	...	8·127	8·006	2·846	·729	1·164	1·109	5·848	73·6	4·60	1,131,616	1·125	1·173
Ilkeston	...	...	...	7·04	6·87	2·3	·8	1·3	1·4	5·8	83	4·4	372,200	1	1·54
Ipswich	...	...	...	8·705	8·52	3·290	·732	1·882	1·306	7·210	82·83	5·904	670,809	1·25	1·045
Keighley	...	...	...	8·962	8·675	3·031	·706	1·172	1·623	6·532	72·88	4·909	277,320	1·45	1·12
Kilmarnock ...	...	...	...	7·413	7·240	2·569	·695	1·235	1·408	5·907	79·6	4·499	314,191	1·25	1·13
Kirkcaldy ...	33	...	...	9·085	8·864	2·574	·758	1·238	1·558	6·128	67·4	4·57	698,804	1	1·558
Lancaster	...	...	...	8·10	7·80	3·11	·87	1·242	2·28	7·50	92·57	5·22	227,984	1·7	1·34
Leith	...	...	...	9·26	8·99	2·47	·86	1·27	1·03	5·63	60·98	4·60	984,428	1·027	1·02
Leyton	...	...	...	9·473	9·293	2·939	1·046	1·808	1·675	7·468	78·834	5·793	3,100,748	1·018	1·644
Lincoln	52	...	...	10·59	10·40	2·34	1·06	1·56	1·41	6·37	60·2	4·96	173,895	1·25	1·128
Liverpool ...	...	...	100,000	12·25	12·02	3·380	1·227	1·460	2·171	8·238	65·6	6·067	26,007,694	1·14	1·9
Lowestoft ...	...	...	...	9·1	8·8	2·60	·5	1·2	1·8	6·1	67·64	4·3	318,601	1·75	1·03
Maidstone ...	...	...	...	8·77	8·295	2·04	·90	1·63	1·40	5·97	71·96	4·57	366,191	1·125	1·217
Manchester ...	...	...	100,000	11·300	11·123	3·420	1·473	1·069	1·608	7·570	63·47	5·962	29,922,197	1·029	1·562
Nelson	134	...	...	11·66	11·60	2·98	·99	2·14	2·48	8·59	74	5·11	241,886	2	1·26
Newport (Mon.)...	...	...	...	10·622	10·385	2·594	1·053	2·402	1·651	7·700	72·49	6·049	1,178,500	1·30	1·22
Nottingham ...	...	6,164	22,500	11·35	11·16	3·06	·93	1·10	1·94	7·03	62·78	5·09	5,806,688	1·25	1·53
Oldham	...	...	...	13·351	13·101	3·186	1·191	3·288	2·316	9·981	74·75	7·665	3,158,752	1·5	1·544
Perth	...	...	...	9·39	8·81	3·08	·40	·77	1·46	5·71	60·79	4·25	295,846	1·25	1·17
Plymouth ...	...	...	4,037	12·066	11·480	2·42	1·11	1·29	2·298	7·12	60·83	4·82	1,159,069	1·66	1·38
Pontypridd ...	...	...	...	13·07	12·84	2·92	·76	3·84	1·85	9·37	71·7	7·52	631,981	1·28	1·48
Rawtenstall ...	...	...	...	10·11	9·699	2·40	·99	1·27	1·69	6·35	62·87	4·66	833,714	1·23	1·37
Rochdale... ...	4,284	...	...	11·292	11·134	2·611	·682	1·524	1·654	6·471	56·2	4·817	2,836,062	1·006	1·694
Rotherham ...	E. ... R.T....	...	1,500	12·37	12·37	3·11	1·15	1·65	2·46	8·37	67·65	5·91	1,669,691	1·25	1·96
Salford	...	12,265	22,000	10·623	10·632	3·112	1·011	1·144	2·050	7·317	66	4·972	9,602,534	1·23	1·667
Southampton ...	1,282	...	5,134	...	...	...	...	...	...	...	...	...	...	...	...
Southend-on-Sea	2,514	1,000	6,000	13·14	12·97	3·03	·85	1·33	2·33	7·54	57·85	5·21	848,538	1·75	1·33
Southport ...	...	...	...	10·303	10·227	2·483	1·213	1·395	1·521	6·612	63	4·958	465,241	1·5	·977
South Shields ...	...	3,194	2,400	10·308	10·160	2·392	1·352	1·075	1·780	6·599	62·4	4·652	1,200,086	1·353	1·293
Stalybridge, &c.	...	...	...	8·084	8·056	2·755	1·079	1·600	1·453	6·887	83·15	5·269	1,803,063	·9	1·614
Stockport ...	...	250	9,137	10·389	10·322	2·413	·923	1·604	·731	5·671	55	4·940	2,078,189	·512	1·348
Sunderland ...	...	...	5,000	12·210	12·148	3·198	·905	·786	1·820	6·709	54·75	4·8	1,802,694	1·5	1·21
Swindon	...	...	...	9·62	9·24	3·06	·89	1·65	1·99	7·59	79·29	5·60	277,568	1·6	1·24
Wallasey	...	4,500	(a) 8,000	12·048	11·896	3·499	1·252	1·160	2·018	7·929	65·8	5·911	1,851,649	1·4	1·44
Walsall	2,479	...	1,000	11·353	11·064	2·834	1·108	1·437	1·888	7·267	64·012	5·379	858 649	1·68	1·164
Walthamstow ...	...	...	...	8·75	8·66	3·02	·62	1·85	1·79	7·28	83·23	5·49	1,491,700	1·375	1·3
Warrington ...	2,498	...	...	12·334	12·193	3·305	1·377	1·615	1·790	8·087	64·22	6·208	531,700	1·5	1·193
West Ham ...	...	273	...	9·713	9·427	3·359	1·314	2·127	1·239	8·039	78	6·41	6,306,731	·75	1·66
West Hartlepool	...	3,018	...	9·77	9·52	2·39	·79	1·49	1·13	5·80	59	4·67	680,972	·78	1·42
Wigan	902	...	...	12·415	12·077	2·791	·866	2·052	1·736	7·445	59·70	5·80	2,186.073	1·187	1·461
Wolverhampton	...	...	3,744	11·239	11·091	2·648	1·267	1·746	1·463	7·124	62·5	5·661	1,712,796	1	1·45
Yarmouth (Gt.)...	...	...	...	7·927	7·752	2·618	·704	1·008	1·575	5·905	76·17	4·30	708,756	1·50	1·046
York	...	1,212	...	9·45	9.31	3·11	·92	·88	1·89	6·80	71·87	4·91	...	...	...

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

									*				Works Cost.		
Belfast	...	...	12,185	10·08	9·93	2·83	·64	1·32	1·07	5·86	58·07	4·79	10,439,797	·658	1·39
Bexley	...	...	...	11·13	12·3	2·53	·85	2·82	·68	6·88	71·1	6·20	487,110	·827	1·66
Birkenhead ...	...	1,000	...	13·058	12·922	3·161	1·115	2·406	1·160	7·842	59·99	6·67	2,341,009	·60	1·936
Bournemouth ...	...	8,947	...	13·52	13·46	3·03	1·05	1·20	(b) 1·99	7·27	53·80	5·28	3,072,169	·65	1·69
Cardiff	10,002	...	...	12·354	12·14	3·843	·992	1·358	·835	7·028	59·1	6·193	4,936,582	·475	1·80
Coventry ...	103	...	...	9·902	9·734	2·971	·945	1·964	·778	6·658	67·2	5·88	1,651,950	·502	1·47
Glasgow	...	...	12,951	10·674	10·612	3·426	1·922	1·432	·515	7·295	59·87	6·266	33,848,947	·366	1·40
Huddersfield ...	8,400	...	...	11·05	10·79	2·92	·70	1·78	1·04	6·44	58·22	5·40	5,398,258	·49	1·93
Hull	...	4,574	10,000	8·61	8·53	2·87	·66	1·68	·61	5·82	67·58	5·26	6,352,263	·44	1·40
Leeds	...	...	81,567	10·936	10·834	2·914	1·016	1·099	·720	5·749	52·57	5·029	18,862,847	·668	1·918
Leicester... ...	...	...	480	9·875	8·682	3·425	·661	1·325	1·469	6·880	69	5·411	7,540,856	·420	1·82
London	...	...	...	E. 9·77 H. 9·51	9·80 9·03	3·24 4·17	1·14 1·64	1·49 3·41	1·02 5·15	6·89 14·37	66·73 151·17	5·69 14·37	152,666,477	·615	2·60
N'castle-on-Tyne	...	25,757	18,000	12·187	11·642	3·297	1·063	1·293	1·015	6·668	53·02	5·653	11,259,266	·382	1·968
Northampton ...	...	652	...	10·89	10·70	2·94	1·10	1·08	2·13	7·25	68	5·12	1,189,423	1·24	1·57
Portsmouth ...	6,568	(t) 6,000	10,000	12·201	11·997	3·092	1·308	·824	·549	5·773	45·88	5·050	3,272,089	·483	1·139
Preston	...	5,041	1,300	10·75	10·54	2·890	1·168	2·164	·700	6·922	64·40	6·222	1,765,250	·407	1·49
Reading	...	1,006	3,000	9·520	9·242	2·165	1·131	1·119	·945	5·360	54·55	4·248	1,180,507	·740	1·15
Sheffield	...	9,032	22,876	10·747	10·666	3·277	·866	1·236	1·345	6·724	61·116	5·379	18,329,775	646	1·979
Wellington, N.Z.	15,431	...	...	16·309	16·189	5·974	·801	2·259	1·850	10·884	65·86	9·034	4,769,149	·906	2·06

* The figures given under "Power" in Table II. include actual works costs only. H—Horse lines. E—Electric trolley system. (a)—Debit balance forward £426.
(b) Including current supplied by Bournemouth and Poole Supply Company. (c) ·161 Army Service allowance. (f) Insurance fund. (i) Including Insurance.
(k) Insurance. (r) Renewals Fund. (s) Military Allowances &c. £2,557. (t) Amounts for 15 months.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Population Served.	Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Traffic Revenue per Mile of Single Track. £	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Average Speed per Hour. Miles.	Average Total Car Hours per Day.	Average Number of Cars in Use Daily.	Number of Cars in Stock.
Aberdeen ...	165,000	1,909,009	24,048,816	12·59	·86	145·8	90	3,121	10/6	·514	1·861	·57	7·6	812	63	83
Accrington...	70,000	548,070	4,637,303	8·4	1·424	66·2	105	2,612	7/10	·85	1·07	·929	7·5	240	23	32
Ashton-u-L.	50,000	477,155	4,886,149	10·240	·657	164·84	109	2,757	9/–	·392	1·223	·81	8	209	12	25
Ayr	33,000	447,725	4,019,771	8·96	1·02	122	103	1,832	10 5	·65	1·25	·75	8	168	12	22
Birmingham	870,000	14,232,902	149,443,199	10·5	1·03	171·8	86·63	5,384	14 9	·76	...	...	...	...	...	...
Blackburn ...	200,000	1,121,769	12,223,569	10·89	1·28	61·12	105	2,528	6/6	·902	1·25	·76	7·50	434	31	61
Blackpool ...	67,500	1,085,653	13,624,514	12·55	1·32	201·8	103	4,370	22/4	·79	...	...	8	...	29	84
Bolton ...	221,000	2,886,180	31,370,166	10·86	1·066	141·49	124·07	2,920	12/8	·582	1·553	·633	7·25	980	70	112
Bradford ...	370,000	6,194,057	70,077,271	11·31	1·059	189	113	2,807	16/6	·84	1·66	·530	7·3	2,402·5	155	252
Brighton ...	133,935	1,108,352	11,837,828	11	1·10	88·38	76·08	3,165	8/1½	·83	1·27	·787	6·41	512	32	53
Burnley ...	175,000	1,644,712	15,867,699	9·65	1·16	96	120	3,544	8/10	·88	1·25	·83	7	798	42	67
Burton ...	48,000	440,021	3,311,355	7·53	1·06	69	...	1,790	6/4	·95	1·505	·58	7·5	...	...	20
Bury	128,202	1,613,357	15,513,264	9	1·07	121·47	99·73	1,904	10 9	·554	1·30	·77	8·54	...	...	54
Chester ...	39,028	347,318	3,275,944	9·43	·95	83·9	95	2,009	6/5	·64	1·27	·8	7	144·57	10·04	18
Chesterfield	50,000	304,376	2,950,774	9·7	1·1	76	122	2,668	5/5	·78	1·38	·75	7·33	126	7	17
Colchester ...	65,000	332,963	2,434,786	7·31	1·32	37·46	86·80	1,689	4/1	·94	·85	·96	6·77	147·14	10·51	18
Croydon ...	181,956	2,803,883	19,847,402	7·08	1·062	109·08	128	4,983	9/9	·850	2·15	·50	8·23	933·60	60	75
Darlington...	62,383	387,714	4,234,783	10·9	·76	62·15	96·5	1,499	4/4	·52	1·219	·45	6·66	151·25	11	18
Darwen ...	...	267,670	2,741,987	10·24	1·28	...	...	2,045	...	·97	..	...	...	...	...	...
Derby ...	124,000	E 1,217,304	12,414,263	10·20	1·003	100·1	...	2,359	8/4½	·73	1	·775	6·5	...	36	50
Doncaster ...	60,000	529,122	5,747,273	10·86	·955	95·79	93·9	1,798	7/7	·711	1·25	·76	7·5	239	18	32
Dundee ...	165,000	1,388,345	18,753,140	13·50	·851	113	...	2,345	8/–	·544	2	·50	7·3	...	...	72
East Ham ...	145,000	1,596,984	18,916,971	11·84	·75	130	...	4,192	8/2	·65	1·71	·63	...	...	..	...
Exeter ...	48,660	449,103	4,611,444	10·27	·93	95	...	2,566	7/4	·603	...	...	...	...	...	24
Gloucester ...	53,972	624,402	4,358,510	7	·92	81	90·60	1,113	6/2	·75	1·5	·65	7·08	250·8	19	30
Halifax ...	176,000	2,330,104	20,707,071	8·89	1·27	118	81·76	2,015	12/8	·852	1·553	·82	7·23	883·74	78	101
Ilford ...	88,000	945,433	9,203,077	10·48	·78	104·6	...	2,462	7/2	·613	1·543	·69	8	...	...	27
Ilkeston ...	32,000	241,548	1,746,382	7·2	·95	...	90	1,942	52/8	·8	1·50	·5	7	101	7	13
Ipswich ...	76,472	642,092	5,610,332	8·73	·975	73·4	64·4	1,532	6/–	·82	1·53	·693	5·47	322·56	20·16	36
Keighley ...	43,500	247,791	3,552,016	14·3	·68	...	55·2	..	4/1	·45	2·17	·459	...	18	7	12
Kilmarnock	36,000	278,987	2,311,708	8·28	·87	64·2	96·83	1,507	4/8	·712	1·13	·86	7·22	98·03	7·88	14
Kirkcaldy ...	39,600	448,469	5,492,120	12·24	·723	138	49	1,882	8/4	·5	1·522	·64	7	158	17	22
Lancaster ...	41,908	170,337	1,559,037	9·15	·852	37·20	75	1,153	2/8	·812	1·71	·5	8	84·7	6·05	12
Leith ...	110,500	968,808	10,220,069	10·55	·85	92·5	126	2,017	6/7	·53	1·32	·72	8·4	315	21	37
Leyton ...	124,735	1,884,742	19,080,335	10·123	·918	153	121	4,077	11/8½	·769	1·847	·504	8·25	14·6	42·5	60
Lincoln ...	20,000	148,440	1,713,542	11·5	·89	85·67	59·3	2,169	6/5	·552	1·75	·428	7	72	4	8
Liverpool ...	840,000	13,657,888	145,656,374	10·67	1·127	173·40	89·09	5,516	16/3	·772	2·514	·39	7·75	5,040	420	596
Lowestoft ...	35,000	307,838	2,706,348	8	1·07	77·32	70·25	2,787	6/6	·703	1·5	·7	5·75	192	12	19
Maidstone ...	25,000	300,945	2,423,514	8·053	1·03	96·94	82	1,478	8/4	·741	1	1	6·8	128	12	19
Manchester	957,500	19,155,051	202,768,420	10·6	1·06	212	93·5	4,835	18/7	·717	2·514	...	7·75	7·2	561	683
Nelson ...	45,000	192,378	2,484,775	12·92	·85	55·22	87·84	2,407	4/2	·665	1	1	5·5	108	6	11
Newport ...	90,000	964,895	9,410,109	9·75	1·09	104	...	2,909	9/3	·79	1·164	·898	...	...	...	44
Nottingham	264,000	3,789,857	41,210,964	10·87	1·02	156	95·28	3,984	13/4	·646	1·75	·442	6·92	...	109	155
Oldham ...	180,000	2,045,840	22,171,712	10·837	1·19	123·176	...	3,018	12/4	·92	1·13	·863	7	...	...	97
Perth ...	35,900	252,216	1,844,588	7·31	1·16	51	...	1,289	5/–	·78	...	...	...	...	...	...
Plymouth ...	112,000	838,142	9 333,087	11·13	1·027	83·33	...	2,666	7/2	·639	...	...	...	...	...	42
Pontypridd ..	50,000	426,639	5,478,483	12·84	1	121	80·18	2,852	40/–	·73	1·5	·53	6·16	221	17	26
Rawtenstall	40,000	605,485	4,869,792	8·04	1·21	122	111	1,540	12/3	·79	1·121	·88	8·50	247·5	15	24
Rochdale ...	130,000	1,772,546	14,286,607	8·06	1·387	109·90	110·30	2,085	11/11	·78	1·07	·90	7·33	660	44	69
Rotherham...	64,000	E 850,548 RT ...	9,828,838 ...	11·55 ...	1·07 ...	153·6 ...	... ...	3,645 ...	13/1 ...	·72 ...	... ...	... ...	... ...	... ...	... ...	... ...
Salford ...	350,000	5,828,238	54,343,908	9·324	1·134	155	104	3,403	14/9	·78	2·20	·46	7·916	2,065·5	153	200
Southampt'n	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Southend ...	78,000	637,366	7,581,104	11·89	1·09	97·2	87	4,708	8/10	·634	1·41	·76	6·5	357	21	31
Southport ...	31,312	475,680	4,772,478	10·033	1·004	152·41	100	1,850	12/9	·7	1·6	·7	6·65	225	15	27
So'th Shields	110,600	927,728	10,479,421	11·296	·899	91	126	3,826	7/1	·58	3·1	·38	7·71	285	20	40
Stalybridge	94,091	1,116,936	8,406,915	7·706	1·06	89·3	...	1,353	8/–	·905	1·22	·72	6·8	...	...	60
Stockport	120,000	1,541,700	12,184,055	7·903	1·290	101·5	97·5	2,358	10/11	·726	1·333	·750	7·500	559	43	50(c)
Sunderland	170,000	1,486,201	18,619,364	13·2	·97	109·5	78·3	3,696	8/10	·536	1·34	·68	7	688	43	70
Swindon ...	53,000	223,383	2,392,470	10·71	·859	45·14	75	1,955	3/4	·709	1·2	·85	6	...	...	12
Wallasey ...	87,000	1,284,938	13,555,876	10·54	1·15	153·51	99·2	3,190	14/8	·75	1·89	·54	7	388·53	35·5	67
Walsall ...	100,000	720,634	6,752,727	9·371	1·184	68	94	1,905	6/7	·775	1·24	·79	7	315	21	39
Walth'mst'w	130,000	1,146,743	13,499,838	11·77	·732	103	104	3,089	6/4	·618	1·18	·86	7·6	430	37	38
Warrington	86,000	445,459	6,012,212	13·474	·903	69·91	102·24	2,344	5/3	·59	1·246	·803	6·39	180·99	11·937	21
West Ham	295,570	3,760,361	42,667,561	11·35	·852	144	90	5,041	10/–	·67	1·85	·50	7·66	1,195·75	93	118
W. Hartlep'l	90,000	479,382	4,261,917	8·89	1·07	47	94	2,163	4/3	·65	1·262	·94	7	203	14	26
Wigan ...	200,000	1,495,786	13,811,709	9·23	1·344	69	97·57	2,427	7/6	·802	1·15	·88	7·4	567	42	73
Wolverh'ton	135,000	1,181,309	12,236,785	10·359	1·06	90·64	89	2,539	8/1	·687	1·25	·879	6·85	651·6	36·2	52
Yarmouth ...	56,000	677,153	4,236,424	6·25	1·239	75·65	80	1,500	7/10	·944	1·25	·76	7	310	23	35
York	82,600	762,540	...	...	...	...	...	...	...	...	...	...	...	...	...	...

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast ...	390,000	6,432,600	62,340,269	9·74	1·02	159	128	2,689	13/8	·60	1·96	·43	8·75	2,014	241	290
Bexley ...	16,500	316,970	2,270,070	7·16	1·55	133	126	2,922	19/10	1·24	1·59	·63	9·5	179	11	16
Birkenhead	137,996	1,209,117	14,822,697	12·25	1·052	107·41	73·46	2,702	9/3	·992	1·39	·66	6·84	483·81	45·09	65
Bournem'uth	120,000	1,815,632	16,967,210	9·34	1·44	141	...	3,103	16/11	·78	1·19	·87	6·8	...	...	91
Cardiff ...	182,729	2,742,546	30,424,407	11·09	1·09	166	85	4,358	15/2	·85	1·44	·736	7·5	1,408	88	130
Coventry ...	135,000	1,100,553	8,730,024	7·9	1·22	65	59	2,832	6/7	·84	1·18	·866	6·2	487	41	51
Glasgow ...	1,150,000	24,214,460	336,260,758	13·887	·764	292·4	105·61	5,404	18/7	·488	2·31	·44	8·11	8,974·78	628·20	856
Huddersfield	160,000	(a) 2,797,276	23,933,065	8·69	1·24	159	84	3,556	15/6	·73	1·34	·69	7·72	1,012·16	63·26	106
Hull ...	291,118	4,551,145	52,087,770	11·44	·745	178·92	123·43	4,879	11/1	·52	2·75	·364	9	1,565·60	97·85	180
Leeds ...	525,000	9,522,737	95,639,268	10·04	1·075	182	115·43	3,747	16/4	(b) ·884	1·93	·539	7·54	3,465	230	345
Leicester ...	232,644	4,137,262	37,914,773	9·146	·947	163	108·35	4,045	12/10	·751	2·18	·45	8	1,451	...	160
London ...	...	E58,706,161 H 272,631	547,253,332 3,244,661	9·32 11·90	1·02 ·76	... ...	117·07 77·12	8,465 1,045	... ...	·73 1·21	... ...	... ...	8·95 5·85	17,972 131·80	1,374 10	1,730 37
Newcastle ...	300,000	5,775,323	65,085,452	11·27	1·073	217	...	4,454	18/8	·592	1·58	·633	...	...	...	223
Northampt'n	91,500	690,177	8,295,941	12·02	·89	90·66	...	2,470	6/8	·603	1·34	·7	...	...	...	33
Portsmouth	246,000	2,438,621	27,554,194	11·299	1·061	112·01	90·29	3,535	9/1	·495	1·66	·62	7	1,065	74	100
Preston ...	120,000	1,025,738	10,340,688	10·08	1·04	86·17	132	2,652	7/7	·764	1·01	·95	7·36	404·7	21·3	33
Reading ...	76,500	924,696	8,881,097	9·6	·96	116	114	2,704	9/4	·54	1·59	·68	7·5	336	25	36
Sheffield ...	485,228	8,810,252	107,023,195	12·147	·878	220	108·86	4,950	16/2	·553	2·917	·371	...	3,215·05	221·728	339
Wellington...	70,000	2,328,849	24,565,376	11·28	1·43	359	85	4,708	44/10	1·031	1·125	·89	7·59	840	75	92

E—Electric trolley system. H—Horse lines. (a) Including 9,467 miles coal haulage. (b) Total expenses per passenger. (c) And 3 trackless cars.

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CONTRACTS AND ORDERS.

Bruce Peebles and Company, Limited, have received an order for the supply of a 750 KW. rotary converter to Wolverhampton Council.

Sheffield Council have accepted the tender of A. Reyrolle and Company, Limited, for the supply of sub-station switchgear, at £4,426.

Edgar Allen and Company, Limited, of Sheffield, have been awarded a contract for supplying points and crossings to Southampton Corporation Tramways.

British Insulated and Helsby Cables, Limited, have received an order for the supply of trolley wire to the approximate value of £743 to Leyton Urban Council Tramways.

John Brown and Company have received a contract to supply sixty-four steel tires at £37 10s. per ton to Southend Tramways Department, delivery to be made when and as required.

Croydon Corporation Tramways have accepted the tender of Siemens Brothers Dynamo Works, Limited, for the supply of Wotan, Tantalum, and carbon filament lamps for the ensuing year.

British Westinghouse Company have received the contract for switchgear required for linking up Poplar Electricity Works with those of the Hackney Council. The amount of the tender was £1,498.

The National Rail and Tramway Appliance Company have received an order from Bradford Tramways Committee for the supply of brake blocks, at an increase of 5 per cent. on the present contract.

Bradford Tramways Committee have accepted the offer of the Dunlop Rubber Company to supply rubber tires for railless trolley cars at ·75d. per mile run per vehicle for two years from February, 1916.

Dover Tramways Committee have been asked to pay an increase of ¾d. per thousand in the price of tickets, the addition being described by the manager as equivalent to £14 a year. The committee decided to offer half of that amount.

Salford Electricity Committee have placed a contract with Andrew Knowles and Sons, Limited, Pendlebury, for supply of 500 tons of Trencherbone slack, 16s. per ton, plus 8d. per ton for canal dues and hire of boats, making a total cost, delivered at the electricity station, of 16s. 8d. per ton.

Bootle Council have allotted the following contracts :—Reason Manufacturing Company, meters ; British Insulated and Helsby Cables, fuse boxes ; Siemens Brothers and Company, stoneware troughing ; Vacuum Oil Company, oil ; Trinidad Lake Asphalte Company, bitumen ; General Electric Company, incandescent lamps.

Glasgow Tramways Committee have placed orders with John Stewart and Company, Limited, for galvanised steel wire ; St. Helens Cable Company, Limited, cable ; Messrs. Stewart and Lloyds, Limited, tubes for canopy rods ; and the British Insulated and Helsby Cables, Limited, three-core cable, ozone-proof cables, and asbestos-covered wire.

The Victorian Government Railways have placed a contract with Messrs. Stothert and Pitt for two 50-ton electric overhead travelling cranes, etc., for the Ballarat and Bendigo workshops, at £2,160 each ; 30-ton electric overhead crane for Ballarat workshops, £1,575 ; and two 10-ton electric overhead cranes for Bendigo and Ballarat workshops at £927 each.

Johannesburg Tramways Committee have advised the Council to accept the following tenders for new plant at the electric lighting and tramways station :—Sykes and Company, two 3,000 KW. turbo-alternating sets, with Parsons' condensing plant, switchgear, etc., £26,395, and spare motor, £798 ; Griffin Engineering Company, wet-air filtration plant, £690.

Bradford Electricity Committee have placed contracts as appended :—Three water-tube boilers, with superheaters, etc., Babcock and Wilcox, Limited ; three economisers, E. Green and Son, Limited ; coalhandling plant, Goodall, Clayton and Company ; two 10,000-gallon boiler feed pumps, J. P. Hall and Sons, Limited ; three cooling stacks, Film Cooling Towers, Limited ; motors, Electromotors, Limited.

Liverpool Tramways Committee have allotted contracts to F. W. Rowlands and Company for steel gears and pinions ; and to the Vacuum Oil Company and C. C. Wakefield and Company for lubricating oils and greases. Tenders for iron castings have been accepted from the Moston Malleable Castings Company, National Rail and Tramway Appliances Company, Interchangeable Brake Block Company, J. Allan, sen., and Son, and J. Needham and Sons.

Salford Tramways Committee have recommended acceptance of the following tenders :—Supply of uniform clothing, etc., for tramway inspectors, motormen, and conductors, for twelve months : Briggs, Jones and Gibson, Limited, Manchester, uniform clothing, winter caps, and extra buttons, etc., approximate value £3,408 ; D. Moseley and Sons, Limited, Manchester, mackintoshes and cap covers, £848 19s. 2d. ; J. E. and F. Collier, Salford, leggings, cash bags, etc., £61 11s. 3d.

Colchester Council have accepted the following tenders :—Electrical equipment of tramcars (for three months), Mr. G. W. Allsop and P. R. Jackson and Company ; overhead equipment (for three months), B.I. and Helsby Cables, Limited ; rubber and fibre (for three months), L. Andrews and Company ; castings (for three months), Stanford and Company ; car fittings (for three months), British Hele-Shaw Company and Stanford and Company ; oils and grease (for a year), Williams and Company.

Manchester Council have approved of the following contracts :—Tramways Department :—J. Mackie and Sons, block tin ; Electricity Department :—Strachan and Henshaw, Limited, one Telepher ash-handling plant ; W. T. Glover and Company, Limited, Chas. Macintosh and Company, Limited, British Insulated and Helsby Cables, Limited, supplies of cable ; Newton, Chambers and Company, Limited, hot-well tank and piping ; British Westinghouse Electric and Manufacturing Company, 15,000 KW. alternator.

Walthamstow Tramways Committee have accepted the following renewals of contracts for annual supplies :—Lamps, General Electric Company ; rubber packing, G. Angus and Company ; trolley heads, W. Wood and Company ; trolley wheels, Anti-Attrition Metal Company ; paints and varnishes, Docker Brothers, R. Kearsley and Company, and L. Berger and Company. For controller fingers, pinions, gear wheels, armature coils, oils and grease, castings, green paint, and car accessories, the general manager is to obtain quotations as and when required.

The Mirrlees Watson Company recently received the following orders for condensing plant :—Manchester Co-operative Society, Limited, Lanarkshire Steel Company, Joseph Crosfield and Sons, Limited, Warrington (two sets), Powell Duffryn Steam Coal Company (two sets), Steel Company of Scotland (three sets), Frodingham Iron and Steel Company, David Colville and Son, Limited, Motherwell, Stanley and Mapperley Collieries, Digby Colliery Company, Moira Colliery Company, and Nobel's Explosives Company, Limited, also a number of separate condensers and air pumps for various munition works and for France and Russia.

Contract for Rails.—In reply to an invitation to rail manufacturers to tender for supplying 600 tons, or any less quantity of tramway rails, for the purpose of doubling the Connaught Road tramways, West Ham Tramways Committee received an offer of 100 tons at £13 per ton. This has been accepted, subject to the sanction of the Board of Trade. The Beckton Road tramway being unproductive, the committee have adopted the suggestion of Mr. J. S. D. Moffet, general manager, that the rails be pulled up and used for doubling the track at Connaught Road. The cost of the doubling is estimated at £970, and of pulling up the rails and restoring the roadway £350. The value of the rails, etc., recoverable is put at £2,000.

Portsmouth Council have accepted the following tenders for tramway supplies :—Steel tires :—Scholey and Company, Limited, 56, Victoria Street, S.W., £3 19s. per tire ; insulating materials :—Bromall Patents Company, Limited ; steam coal :—Pensford and Bromley Collieries, Limited, 21s. 11d. per ton ; insulating tape :—Spicer Brothers, Limited, P. R. Jackson and Company, Limited, Micanite and Insulators Company, Limited, Mica Manufacturing Company, Limited, General Electric Company, Limited, Carr Brothers, Limited ; incandescent lamps :—British Thomson-Houston Company, Limited ; overhead line material :—Fleming, Birkby and Goodall, Limited, F. Smith and Company, Limited ; lubricating oils, etc. :—Engelbert and Company, Vacuum Oil Company, Worsingham and Company.

PLEASURE CAR IMPORTS PROHIBITED.

In pursuance of the movement for limiting expenditure on luxuries and for freeing shipping for the transport of necessaries, a Proclamation was issued on March 21 under which the importation of the following articles into the United Kingdom is prohibited as from March 27 :—

Motor cars, chassis, motor cycles, and parts and accessories of motor cars and motor cycles (other than tires), with the exception of the motor cars, chassis, accessories, and parts at present exempted from import duty under Section 13 (4) of the Finance (No. 2) Act, 1915.

Since last summer there had been an import duty of 33⅓ per cent. imposed on such cars. The prohibition will be subject to the issue of licences by the Board of Trade, but such licences will not in general be issued except where evidence is forthcoming that the goods were either (*a*) actually *en route* for the United Kingdom at the date of this notice, or (*b*) paid for at this date.

Supply of Rails, Fishplates, and Tires.—With a view to securing a supply of rails during the next twelve months the special committee of the Tramways and Light Railways Association have asked members to supply the secretary with a statement showing the minimum quantity of rails and fishplates required by them to keep their undertakings in operation. Application will be made to the Ministry of Munitions for permission to have the supplies prepared and delivered. There will be no alteration in the price for steel tires during the present quarter.

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PERSONAL.

Mr. A. Grant has been appointed manager for India of the British Insulated and Helsby Cables, Limited.

Mr. J. W. Horton, traffic superintendent, York Corporation Tramways, has been granted an increase of salary according to scale.

Mr. D. Macfarlane Macleod has been appointed chief engineer to the Clyde Valley Electrical Power Company, after six years' service as resident engineer.

Mr. H. Pilling, general manager and engineer of the Accrington Corporation Tramways, has been granted an increase in salary of £50 by the unanimous vote of the Town Council.

Mr. R. Burton Chadwick, recently chairman of the Liverpool Shipowners' Association, has been appointed by the Minister of Munitions to act as the director of Munitions Overseas Transport.

Mr. F. W. McLean, formerly district engineer in Dunedin, has been appointed chief engineer of the New Zealand Government Railways. In 1878 Mr. McLean took first-class honours in engineering at Edinburgh University.

Mr. W. A. Scott, works manager of Bruce Peebles and Company, Limited, of Edinburgh, has been presented with a canteen of cutlery and a silver cigarette case by the workmen and staff, on the occasion of his marriage to Miss A. Mann, of Edinburgh.

Mr. W. A. Cocking, engineer to the British Automobile Traction Company, Limited, who had been named as manager of the new Cotton Industries Motor Transport Company, Limited, Manchester and Liverpool, is remaining with the first-named company.

Mr. P. P. Wheelwright, electrical engineer to Blackburn Electricity Works and Tramways, has been granted an increase of £100 per annum in his salary of £700 in order to bring his remuneration up to the level of salaries paid to other officials of similar standing.

Inspector W. Taylor, of the Leeds Corporation Tramways, has an unbroken connection of forty-two years with the city tramways. This fact was mentioned by Mr. J. B. Hamilton, the general manager, in a lecture that he delivered on "The Romance of Leeds Tramways."

Mr. E. J. Walsh, chief assistant engineer at Kilmarnock Corporation electricity works, has been appointed resident engineer to Musselburgh and District Electric Light and Tramways Company. The Kilmarnock employees have presented him with a purse of sovereigns.

Mr. David James, manager of the Swansea Improvements and Tramways Company, and the South Wales Transport Company, Limited, is a member of the Appeals Tribunal under the Military Service Act for Glamorgan, and the county boroughs of Swansea, Cardiff, and Merthyr.

Alderman H. W. Littler, the chairman of the Tramways and Electricity Committees of West Ham Corporation, has resigned his membership of the Council. The committee have passed a resolution expressing high appreciation of his services in the development of the two undertakings.

Mr. W. F. Long has been presented with a piece of silver plate to mark his retirement from the position of city electrical engineer of Cape Town. Mr. S. J. Clunas, manager of the power-station, has been appointed acting city electrical engineer, and Mr. Purvis, his assistant, has become the manager.

Mr. Pakenham W. Beatty has resigned the position of chief engineer to the Lacroze Tramway Company of Buenos Ayres, which he has held since June, 1913, in order to take up the position of chief engineer of the Buenos Ayres Underground Railway. This undertaking is owned by the Anglo-Argentine Tramways Company of Buenos Ayres.

Mr. C. J. Spencer, general manager, Bradford Corporation Tramways, has been appointed vice-chairman of the Lord Mayor's Citizens' Contribution Committee, of which Mr. T. Roles, the city electrical engineer, is also a member. The work of the committee is to impart system to the collection of funds for replenishing the Lord Mayor's War Relief Fund.

Mr. H. J. Nisbett, manager and engineer, Torquay Tramways Company, and the staff were commended for their work during the past year by Mr. W. B. Cownie, who presided at the annual meeting. Mr. Nisbett was described as a man who was never beaten, who, in addition to carrying on the tramway traffic under great difficulties, had started important work for the Government.

Mr. Gerald N. Murphy, son of Mr. W. M. Murphy, managing director, Dublin United Tramways, has been appointed a director of Dublin and Lucan Electric Railway Company, to fill a vacancy caused by the death of Captain Vesey. At the annual meeting Mr. J. W. Hill, the chairman, said the directors were sure that Mr. Murphy's experience of tramway and railway work would greatly assist them.

Mr. Charles Challenger, manager of Bristol Tramways and Carriage Company, with the assistance of those men who are ineligible for military service, is largely carrying on the beneficent Red Cross ambulance work in the district of which the city is a centre of great activity. At the company's annual meeting Sir George White, the chairman, referred to the able and patriotic leadership of Mr. Challenger in this work.

Mr. J. W. Dugdale has resigned his position of general manager and engineer of Oldham Corporation Tramways. Some time ago he met with an accident at Sheffield which has affected his health. This reason, combined with the great difficulty now encountered in carrying on the tramways owing to the loss of men for military and munition service, led him to place his resignation in the hands of the tramways committee. They have accepted it with regret.

Mr. A. L. C. Fell, the chief officer of the London County Council Tramways, has just passed through a very serious and critical illness. He is now approaching convalescence, but it will be some two or three months before he can resume duties. Meanwhile his place will be taken by Mr. J. K. Bruce, the deputy chief officer of tramways, particularly as one of the representatives of the Council on the Rolling Stock and the Permanent Way and Building Conciliation Boards.

London County Council Highways Committee.—The following members of the London County Council will form the Highways Committee during the ensuing year:—Sir J. Benn, Messrs. D. Davies, G. A. Gillett, A. O. Goodrich, W. Haydon, D. Hazel, T. F. Hobson, G. H. Hume, W. Hunt, and H. Marks. Captain T. Prestige, Messrs. A. H. Scott, P. C. Simmons, W. J. Squires, H. Ward, and A. W. Yeo. Mr. G. H. Hume has been re-appointed chairman, and Captain Prestige vice-chairman.

Sir John Courtis, chairman of Cardiff Tramways Committee, and a former Lord Mayor of that city, has presented the Corporation with a photogravure of the members and chief officials who were present in the Assembly Room of the City Hall in June, 1913, on the occasion of the visit of the King and Queen, and the knighting of Sir John Courtis. The photogravure was unveiled by the Lord Mayor at a meeting of the Council on March 13, when Sir John Courtis was thanked for the gift.

Mr. C. W. Shepherd, who recently resigned the position of general manager of the Edinburgh and District Tramways Company, has, at the request of the directors, retained the position of secretary. At the annual meeting the chairman said he regretted that Mr. Shepherd had found it necessary, owing to indifferent health, to resign his position as general manager. He had been a tremendous asset to the company, and the board were glad that they had been able to retain his services as secretary.

Mr. T. R. Whitehead, engineer and general manager, Coventry Corporation Tramways, has been granted an increase of salary from £500 to £600 per annum. Councillor Vernon Pugh, chairman of the Tramways Committee, stated that since the undertaking was purchased by the Council a sum of £22,000 had been expended on extensions, and the amount would have been much larger but for the war. The receipts had increased from £39,153 to £45,404. In the week ended March 19 last the passengers numbered 243,572, as against 173,572 in the corresponding week of 1913. There would be a substantial profit on the year ended March 31, 1916, but whether the Council would be able to deal with it or whether the Treasury would require a part of the sum he could not say.

Mr. E. D. Fitzmaurice was presented, at the offices of the British Electrical Federation, with an inscribed gold watch on leaving to take up a post as permanent way engineer to the Cape Electric Tramways, Limited. Mr. Fitzmaurice, who received his training in the railway world, joined the engineering staff of the British Electrical Traction Company about fourteen years ago as assistant permanent way engineer. Later he became the permanent way engineer, and on the formation of the Federation transferred his services in a similar capacity to that body. The presentation was made by Mr. Emile Garcke on behalf of the directors, staff, and many of the managers of the associated undertakings. Mr. Fitzmaurice was a very popular member of the staff, and he leaves for the Cape with the regrets and good wishes of a very wide circle of business friends.

Bombay Tramways Directorate and Staff.—At the meeting in Bombay at which the Electric Supply and Tramways Company agreed to transfer the entire administrative control and management from London to Bombay, in order to avoid the heavy income-tax, Sir Sassoon David, the chairman, said the present London board had proved very efficient. It comprised men of the high personal character and well-known administrative abilities of Sir Charles Ollivant, its chairman, and Sir Walter Hughes, and others with a technical knowledge unrivalled in London. It would not be possible to obtain a board in Bombay possessing special qualifications of the same calibre, but these deficiencies the Bombay Board, should the transfer take place, would no doubt do its best to remedy by retaining the very competent engineering staff which the company possesses there, and by supplementing it, when necessary, by obtaining the best consultative technical advice. The directors would regard as a most serious loss any severance from Mr. Rimington, the managing director, and the chairman explained to the meeting the nature of the arrangement it was proposed to enter into with the managing director by which his services would be retained for some months annually in Bombay.

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The late Mr. Thomas Parker, who designed the Liverpool Overhead Electric Railway, and was a director of the Metropolitan Railway, left estate valued at £13,380.

Mr. F. W. Lacey, borough engineer of Bournemouth, died on March 24, at the age of 60 years. Mr. Lacey constructed the permanent way of the Corporation tramways.

Mr. R. A. Dawbarn died on March 6 at the age of 55 years, after a short illness. As a member of the firm of Messrs. Mordey and Dawbarn, consulting engineers, he had carried out many electrical installations during the past sixteen years, both in this country and abroad. Formerly Mr. Dawbarn was with Mr. J. S. Raworth while that gentleman was superintending engineer to the Brush Company, in which capacity he was engaged in work in Great Britain and Australia.

WITH THE FORCES.

Inspector McGovern, of Colchester Corporation Tramways, who is serving with the Essex Yeomanry, has been promoted to the rank of regimental quartermaster-sergeant.

Lieutenant R. Twelvetrees, who has been gazetted captain, is attached to the headquarters staff of the British Expeditionary Force in the capacity of Inspecting Officer of the Army Service Corps Mechanical Transport.

Private F. Mottershead, 17th Lancashire Fusiliers (T.F.), who has been awarded the D.C.M. for volunteering to find the entrance to one of the enemy's mine shafts, was an employee of the British Westinghouse Company at Trafford Park.

Gunner J. Mankinney, a former motorman of the West Hartlepool Corporation Tramways, has been awarded the D.C.M. for gallant services in the field. At the March meeting of the Council, Ald. R. Martin, chairman of the Tramways Committee, moved a resolution offering the congratulations of the Corporation to the gunner.

Corporal J. N. Smith, of the Nelson Corporation Tramways staff, has won double distinction in France. He is in the East Yorkshire Regiment, and at Ypres he cut barbed wire entanglements under heavy fire, thus allowing his section to advance. For a second act of gallantry he has received the Russian Order of St. George.

Captain A. H. Bowden, who was formerly engaged at the London and North-Western Railway shops at Wolverton on work connected with the London—Watford electrification, is now a brigade machine-gun officer. Up to January last he was in command of the machine-gun section of the 11th Royal Warwickshire Regiment. He recently introduced a successful flash protector and night-light pointer for machine guns.

Sergeant E. Collard, who, at the outbreak of the war, was recalled to the 1st Notts and Derbyshire Regiment, from the London County Council Tramways, has been awarded the D.C.M. for carrying a message from the supports to the firing line under heavy fire. Although wounded he delivered the message and returned with a reply. He took part in the fighting at Mons, on the Marne, the Aisne, and at Ypres.

Corporal James, 87th Field Ambulance, R.A.M.C., formerly a conductor on the Corporation Tramways at Liverpool, has been awarded the D.C.M. for gallantry under shell fire at Suvla Bay on August 22 last. He went out alone to help his comrades, who had suffered many casualties on going to Hill 53 to succour a number of wounded soldiers. The only man of the party left uninjured was Private Jennings, another Liverpool conductor.

Lieutenant J. Smith, Swansea Tramways Company, has for some time been serving in France with the South Wales Borderers. In a letter to the "Record" of the B.E.F. Mutual Aid Fund, he says: "We have a number of London 'buses, used for carrying troops some distance up the line. I always am reminded of tramways and transport, and when I happen to be near a French mine I usually visit the engine-room—one does appreciate a change."

Major F. J. Chapple, power and rolling stock superintendent, Potteries Electric Traction Company, has been mentioned in despatches by Lord French of Ypres, for services with the North Midland Heavy Battery. The gallant officer joined the battery on its formation and went to France in February last. The battery has seen a great deal of service, and during the indisposition of the colonel the command fell to Major Chapple. He has been associated with the Potteries Company for the past 14 years.

2nd Lieutenant H. A. Johnston, Royal Flying Corps, who was killed in France on March 4, was formerly with Messrs. Siemens Brothers, Dynamo Works. He entered the corps as a private. Although only 24 years of age, he had fitted wireless installations in many countries.

2nd Lieutenant A. F. Goodfellow, 3rd Connaught Rangers, who was killed in France, was assistant engineer of the Burma Railways. While a student at the Central Technical College, South Kensington, he became Siemens medallist and David Salomons scholar, and obtained diplomas in electrical, civil, and mechanical engineering.

TRAMWAY AND LIGHT RAILWAY NOTES.

BRADFORD.

A Regulation to Aid Car Loading.

At the instance of the Watch Committee, the City Council on March 14 adopted a regulation under which six or more persons waiting at any stopping place or terminus specified in a schedule submitted to the Corporation are to be required to form up in a line or queue, and in that order enter the car. In answer to an inquiry whether under section 61 of the Corporation Act of 1903 there was power to prosecute, and what was the penalty, the Town Clerk replied that there was such power. Councillor Palin, who is secretary of the Tramwaymen's Union, remarked that the proposals were insufficient, but were the best that could be made at present, and would involve people submitting themselves to discipline.

BRISTOL.

Tramways Purchase Question.

A report was presented to Bristol Corporation on March 14 by the Tramways Option Committee, stating that the Tramways and Carriage Company were unwilling to pay any wayleave, and the concessions "in the way of revision of fares or otherwise" were not sufficient to justify a waiving of the option of purchase for 7, 14, or 21 years. In these circumstances the committee asked for leave to keep the option alive under the Special Acts Extension of Time Act. Alderman Pearson, chairman of the committee, in moving the adoption of the report, said the committee could not advise the acceptance of the company's offer to take Corporation stock at 5½ per cent. in payment for the undertaking. Councillor Gane, in seconding, said the failure of the negotiations was due to a number of circumstances, one of which was the division of opinion in the Council upon the main question. The committee had since tried to obtain for the public a two-mile ride for a penny. At present the penny ride slightly exceeded 1½ miles, as against 1⅞ miles at Edinburgh, Bolton and Nottingham, 2 miles at Leeds and Belfast, 2¼ miles at Glasgow and Birmingham, and over 2½ miles at Salford, Liverpool, Sheffield, Hull, and Manchester. On March 28 the Council rejected a motion to direct the Option Committee to present a return of all their expenditure, the matter being deferred until after the decision of the Corporation to purchase or otherwise. A reference to the purchase question will be found in the remarks of Sir George White, chairman of the Tramways and Carriage Company, at the annual meeting.

CARDIFF.

Proposal to Utilise Trailers.—Utility of Books of Tickets.

Owing to the shortage of car hands, only 60 per cent. of the Cardiff cars are now running. Mr. A. Ellis, the general manager, has asked the Board of Trade for sanction to the use of trailers in order to assist in making good the deficiency. Apparently the management do not look upon the expedient of women drivers as being one likely to meet the needs of the traffic, for two women were trained for that work several months ago. Complaint having been made of trouble caused to conductors through passengers not providing themselves with small change, the manager reminded the tramways committee that books of tickets were obtainable. As this facility does not appear to be generally known, he has arranged that greater publicity shall be given to it. Councillor Blower suggested that at busy places people might be booked before boarding the cars, but the committee were of opinion that the books of tickets would answer the purpose.

GLASGOW.

Prospect of a Record Year.

The darkening of the streets and cars is not now affecting the tramway receipts so much as was at first the case, and the financial year ending on May 31 is likely to provide another record. The traffic return to April 1 shows receipts exceeding £952,622, or £70,773 in advance of the corresponding period of 1914. For the complete year the revenue is likely to considerably exceed a million sterling.

LEEDS.

A Record Year.—The Capital Outlay for Women Conductors. No General Increase in War Bonus.—Payments to Dependents.

It is estimated that the financial year of the Corporation Tramways ended on March 31 will show a surplus of £91,000 available in relief of the rates, after paying all the customary charges, including £25,000 in rates. For 1914-15 the grant to the rates was £81,000. The sum of £91,000 is the equivalent of a 10d. rate. In opposing a motion at a meeting of the Corporation that the terms of employment for female conductors be the same as for men, Alderman R. A. Smithson, chairman of the tramways committee, said that women on the average were drawing about 27s. 6d. per week, and were earning more as a start than the men were in pre-war times. It was a temporary employment, and, so far as his experience went, the women were satisfied with their pay. The

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department were not making money out of them. To recoup themselves for the capital outlay and expenditure rendered necessary by the conditions of employment they would need to retain their services for some years. The Corporation have refused to grant an increase in wages applied for by the tramway employees, but in special cases the bonus will be advanced. Over £40,000 a year is being paid to dependents of enlisted municipal employees. This sum nearly equals a 5d. rate, and it will be added to for the dependents of employees who have enlisted during the last months of voluntary recruiting.

LONDON.

THE DUPLICATION OF PASSENGER SERVICES.

In reply to questions addressed to him at the meeting of the County Council on March 21, Mr. G. H. Hume, chairman of the Highways Committee, said the committee were still negotiating with the London General Omnibus Company in order to prevent the duplication of passenger traffic services during the war. It would be the care of the committee not to commit the Council.

MANCHESTER.

HEAVY MOTOR VEHICLES ON THE TRACKS.—TRAMWAY MANAGER'S WAR COLLECTIONS.

The Manchester, Liverpool and Counties Commercial Motor Users' Association have discussed a recommendation reported to have been made by the general manager of the Corporation Tramways for prohibiting motor wagons using tramway tracks. The meeting resolved to ascertain the views of the Tramways Committee on the proposal, and to ask the Association's Parliamentary agents to inquire as to the possibility of any Bill being put forward on the question. Commenting on the proposal, the *Commercial Motor* says:—"We can conceive that in certain thoroughfares in Manchester the interests of all parties will be better served by some arrangement of the kind, subject to due safeguards." The citizens are to be congratulated upon the continued success of the collections in aid of war funds by means of boxes affixed to the Corporation tramcars and motor omnibuses. Their thanks are due to Mr. J. M. McElroy, the general manager, for supplying the exhortation and persuasion that has resulted in such liberal support being forthcoming. Up to March 11 the total amount collected for forty-three charities was £20,304.

NEWCASTLE-ON-TYNE.

NOTICE TO FORGETFUL PASSENGERS.—NO RATE RELIEF.

Notices have been posted in the Newcastle cars warning passengers that they are responsible for paying the fare, and that the penalty for non-payment is 40s. Observation is being kept upon workmen who leave cars *en route* without tendering the fare. Proceedings will be taken against offenders. It is claimed that there is no excuse for workmen, as they can provide themselves with books of weekly coupons. Owing to a reduction of 5d. in the pound in the Corporation rates for the ensuing year, no call has been made upon the Tramways Committee for a contribution in relief of the rates.

SHEFFIELD.

LITIGATION OVER HOLIDAYS.

The case of a dismissed Sheffield conductor against the Corporation for a week's wages in lieu of a week's holiday, which was reported in our issue of January 15, is occupying the attention of the Law Courts. At Sheffield County Court, on January 7, Judge Benson decided in favour of the plaintiff, but on March 27 the King's Bench Division reversed the decision. Now there is to be an application to the Appeal Court by the ex-conductor, who is supported by the Tramway and Vehicle Workers' Union. According to counsel for the Corporation, there are some eighty cases dependent on the result of the case. Mr. Justice Lush, in delivering judgment (in which Mr. Justice Rowlatt concurred), said that under the terms of the Corporation's resolution there would be a breach of contract if a man did not receive his holiday or a week's pay before the end of October, but if the contract of service were terminated before the expiration of that period he did not think there was any breach of contract. The Corporation's appeal was allowed with costs, and notice of appeal by the respondent was given.

SWANSEA.

CORPORATION PURCHASE THE COMPANY'S POWER STATION.

A step that is likely in the future to facilitate the electrification of the Mumbles Railway, which, during the summer, carries a very heavy traffic, has been taken by Swansea Corporation and the Swansea Tramways Company, who are the lessees of the railway on a lease of 999 years. An arrangement has been concluded for the Corporation to take over the company's power station and to supply them with the whole of the energy they require, instead of only one-fourth as at present. The average price paid by the company for energy is subject to a coal clause, the price rising when the cost of coal exceeds 16s. per ton, and falling when the price falls below 15s. per ton. The company are to hand over the power-station to the Corporation free of ground rent, to be held by them as their own property, and in consideration the Corporation agree to pay the company the sum of £400 per annum for 26 years.

YORK.

PLANS FOR DEALING WITH OVERCROWDING.

The Tramways Committee have approved of proposals submitted by Mr. J. W. Hame, the general manager, for dealing with overcrowding during the workmen's traffic. He proposes to enforce the by-laws, particularly No. 18, which provides as follows:—"No person shall hold or hang on by or to any part of any car, or travel therein or thereon, otherwise than on a seat provided for passengers, except in the interior of the car with the consent of the conductor." In dealing with the Haxby Road route, the manager is arranging for barriers to be placed, so that passengers must form in queues. Those who have taken a return ticket will be allowed in the barriers first.

LONDON TRAFFIC REPORT.

The eighth annual report of the London Traffic Branch of the Board of Trade has been much reduced in size, and is shorn of its usual blue cover. No diagrams are published, owing to the abnormal condition of street traffic during the war. The report gives statistical tables relating to the year 1914, but in the case of the London County Council Tramways the information is brought up to the year ended March 31, 1915. In a prefatory note, Colonel R. C. Hellard states that consideration by the Sectional Conferences at the Local Government Board and in the field of the various recommendations for the improvement of the arterial roads in the metropolitan area was continued, and the more important of the proposals made by the branch in the published road scheme had been approved. A summary of the report is deferred to a later issue.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

Electric car-lighting equipments (3,559)—Albion Motor Car Company.
Covers for outside seats of omnibuses (4,701)—C. and R. Allen.
Electric signalling apparatus (4,254)—F. G. Baily.
Covers for outside seats of omnibuses (4,701)—F. Belcher.
Railway route indicating and signalling devices (4,104)—R. G. Berry.
Device for securing points on railways (4,793)—H. A. Braithwaite.
Locomotives (4,334)—British Thomson-Houston Company, Limited.
Starting mechanism for automobiles (3,658 and 3,659)—British Westinghouse Electric and Manufacturing Company, Limited.
Signalling device for road vehicles (4,160)—C. W. Bunn.
Clutch mechanism for motor vehicles (4,314)—F. T. Burgess.
Electric cables (2,986)—Callender's Cable and Construction Company.
Electrical systems for engines (4,688)—W. A. Chryst.
Apparatus for recording electric signals (3,543)—E. R. Clarke.
Clutch mechanism for motor vehicles (4,314)—J. A. Cole.
Manufacture of solid rubber tires (3,066)—F. Cole.
Tensioning devices for couplings of railway vehicles (4,641)—T. F. Craddock (*Craven and another*).
Means for controlling electric lighting of motor vehicles (4,343)—W. Curtis.
Disc wheels for motor vehicles (3,150)—W. M. Douglas.
Signalling systems and apparatus (4,806)—A. F. Dixon.
Solid rubber tires for vehicle wheels (4,528)—Dunlop Rubber Company.
Motor car indicator (4,177)—H. O. Faulkner.
Fuel supply of motor vehicle engines (3,313)—H. Ferguson.
Danger guard and indicator for tramway vehicles (4,548)—W. C. Fletcher.
Brake blocks, clutch linings, and other friction surfaces (3,824)—H. Frood.
Gear-boxes for automobiles (3,574)—T. Gill.
Tire-making machines (4,444)—Goodyear Tyre and Rubber Company.
Automatic danger signal alarm for railways (3,010)—L. C. Grouse.
Trolley head for tramcars (4,373)—S. Henshaw.
Clutch mechanism for motor vehicles (4,314)—Humber, Limited.
Rails and railway crossings (4,224)—W. J. Infield.
Apparatus for guiding trolley pulley of electric cars and locomotives to overhead wire (4,691)—W. G. Jenkins.
Resilient vehicle tires (2,963)—S. Johnstone.
Electrical systems for engines (4,688)—C. F. Kettering.
Brake mechanism (3,812)—W. O. Kuhn.
Driving mechanism for motor vehicles (3,813)—W. O. Kuhn.
Transmission gearing for motor vehicles (3,814)—W. O. Kuhn.
Steering gears for motor vehicles (3,815)—W. O. Kuhn.
Solid rubber tires for vehicle wheels (4,528)—C. Macbeth.

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Process of retreading old motor car tires (3,240)—C. D. McGiehan.
Braking means for road vehicles (4,394)—E. Massis.
Speed transmission gear (3,579)—F. Molyneux.
Route indicating and signalling devices for railways (4,104)—H. W. Moore.
Mechanism for operation and control of variable speed gears (3,723)—D. Napier and Son.
Automatic train signal and stop (3,530 and 4,337)—National Safety Appliance Company.
Life-saving guards for the wheels of motor vehicles (4,570)—E. Presland.
Device for securing points on railways (4,793)—Railway Supplies Company.

FOR HIGH-CLASS
CONDENSING PLANT
WRITE TO
THE MIRRLEES WATSON CO., LTD.,
SCOTLAND STREET, GLASGOW.

Means of propulsion for motor-driven vehicles (3,843)—W, Reah.
Manufacture of solid rubber tires (3,066)—T. H. Roberts.
Mechanism for operation and control of variable speed gears (3,723)—A. J. Rowledge.
Steering gear for motor vehicles (4,358)—F. H. Solomon.
Means of control for petrol-electric cars (2,920 and 3,331)—W. A. Stevens.
Vibration-preventing mechanism for vehicles (4,745)—W. Sumner.
Lubricating locomotives, etc. (3,856)—T. C. Thomsen.
Self-propelled vehicles (3,111)—G. Watney.
Power-transmission gear for self-propelled vehicles (3,112)—G. Watney.
Cylinders for petrol engines (3,687)—E. A. Watson.
Automatic car couplers (3,865)—J. Willison.

Specifications Published.

1914.

Trolley poles for electrically-propelled vehicles (24,074)—Meyer.

1915.

Points for tramways, etc. (8,515)—Edgar Allen and Company and Lockwood.
Points or switches for tramways and railways (7,680)—Edgar Allen and Company and Pigott.
Steam automobile vehicles (1,548)—D'Espujols.
Combined electric lighting and starting apparatus for motor vehicles (4,895)—Duca, Naldini, Massavelli, and Bellone.
Vehicle wheels (2,638)—Dunlop Rubber Company and Macbeth.
Truck or trailer for vehicles (2,620)—Geiger.
Road wheels of automobiles (3,535)—Goodyear.
Brakes for tramway and railway vehicles (2,838)—Hatton.
Hand levers controlling electric motors for operating railway signals and points (10,438)—Hibbert.
Self-propelled vehicles (4,469)—Landon and Martyn.
Vacuum brake apparatus (3,948)—Luard.
Motor vehicle bodies (6,852)—Maddox.
Trolley wheels (12,100)—Pike.
Steel car wheels (2,788)—Ramsden.
Emergency slipper brakes for auto-vehicles (2,908)—Ray and Milligan.
Electro-mechanical driving arrangements for vehicles (14,548)—Reik, and Oesterreichische Daimler-Motoren Akt.-Ges.
Motor trains (14,549)—Reik and Oesterreichische Daimler-Motoren Akt.-Ges.
Fluid-pressure braking apparatus (3,340)—Rendell.
Brake mechanism (8,817)—Rote.
Detachable wheels for motor cars (4,292)—Adolph Saurer.
Leaf springs for motor vehicles (2,504)—Schwarz.
Upper clip for anchor insulators of conductor rails for electric railways (7,498)—Scott.
Reversible car seats (9,815)—Smith.
Resilient tires for road vehicles (2,778)—Van Der Velde and Hosking.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1915. WEEKS ENDED.					1916. WEEKS ENDED.					AGGREGATE.		
	Mar. 6.	Mar. 13.	Mar. 20.	Mar. 27.		Mar. 4.	Mar. 11.	Mar. 18.	Mar. 25.		Wks.	1916.	Increase or Decrease.
	£	£	£	£		£	£	£	£			£	£
Anglo-Argentine	51,890	50,619	53,433	51,827	...	60,023	50,723	52,078	51,257	...	13	609,322	– 1,354
Auckland	...	19,907	(28 days)	...	...	...	20,711	(28 days)	...	...	36	189,937	+ 3,002
Burma ... ... Rs.	3,344	3,483	3,624	3,774	...	3,487	3,768	3,868	3,682	...	34	...	+ 7,238
Calcutta ... ... Rs.	56,894	65,331	63,300	62,970	...	70,956	69,488	67,883	62,636	...	13	823,914	+ 50,041
Madras ... ... Rs.	(2 weeks)	27,730	(2 weeks)	32,858	...	(2 weeks)	32,004	(2 weeks)	33,302	...	13	188,291	+ 19,204

Companies Issuing Monthly Statements.

	1914.			1915.			1915.			1916.			Wks.	AGGREGATE.	
	October.	Nov.	December	Jan.	Feb.	March	October.	Nov.	December	Jan	Feb.	March		1915-16.	+ or –.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Brazilian Street Mlrs.	...	...	...	...	...	...	...	...	...	...	...	...	...	—	—
BrazilianTraction Mlrs	6241170	5929730	6,010,490	5,996,190	5,797,500	...	6793000	6336000	6,527,000	6,430,000	6,079,000	...	9	12,509,000	+ 715,310
Brisbane	28,763	28,600	30,890	29,620	34,050	...	31,880	31,120	33,960	32,280	30,320	...	9	62,600	+ 6,390
British Columbia $	661,000	648,485	674,063	640,495	558,512	...	538,826	562,782	603,667	591,949	572,935	...	35	4,405,030	– 792,876
Buenos Aires Pt. & C.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Buenos Ayres Lacroze	42,341	42,256	44,000	43,301	38,877	44,332	42,516	42,603	43,528	40,596	39,137	42,219	39	372,882	– 6,594
Cape Town	12,682	...	15,869	15,660	...	...	...	13,870	16,589	16,030	...	...	—	—	—
Carthagena& Herrerias	1,543	1,379	1,255	904	1,822	2,436	2,169	2,090	2,129	2,841	1,585	2,991	13	7,417	+ 2,255
Cordoba	12,904	12,468	12,091	11,945	...	...	13,433	13,785	13,025	12,329	...	...	44	136,477	+ 5,102
East India	2,007	2,029	1,839	1,914	1,649	1,846	2,069	2,065	2,062	2,015	1,863	2,196	35	16,590	+ 1,214
Kalgoorlie	2,525	2,414	2,905	2,372	...	...	2,675	2,611	3,018	2,236	...	...	5	2,236	– 136
La Plata	4,540	4,540	4,452	4,540	4,016	...	4,405	4,545	4,564	4,533	4,346	...	9	8,879	+ 331
Lima	30,646	29,712	32,411	33,043	30,164	...	32,208	30,703	34,685	34,014	32,900	...	9	66,914	+ 3,707
Manila ... ... $	125,750	129,000	132,500	...	...	...	124,131	129,447	141,350	...	...	...	52	1,495,534	– 108,031
Melbourne	...	...	...	62,729	...	...	...	...	72,658	69,879	...	...	5	69,879	+ 7,150
Mexico ... ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Montevideo	26,500	27,081	28,605	32,459	30,008	...	27,167	28,407	31,305	34,252	32,502	...	17	126,466	+ 8,313
Port Elizabeth ...	...	...	...	...	...	...	...	3,110	4,360	4,193	...	...	—	—	—
Puebla ... ... $	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Rangoon	4,600	4,405	4,459	4,689	...	...	4,886	5,028	4,492	4,763	...	...	5	4,763	+ 74
Toronto ... ... $	849,636	824,634	...	843,351	767,326	...	792,001	851,113	...	906,350	846,256	...	9	1,752,606	+ 141,929
Winnipeg ... $	330,562	330,398	368,400	350,681	314,658	...	286,146	323,025	377,121	297,560	293,250	...	9	590,810	– 39,844

(Continued on page 288)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1915. WEEKS ENDED.				1916. WEEKS ENDED.				AGGREGATE.		
	Mar. 6	Mar. 13	Mar. 20	Mar. 27	Mar. 4	Mar. 11	Mar. 18	Mar. 25	Wks.	1916.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1.576	1.609	1.650	1.533	1.724	1.640	1.581	1.623	42	75.159	+ 4.734
Accrington Corporation	*	...	...	...	...	...	...	...	—	—	—
Ayr Corporation	224	225	230	236	239	235	231	244	46	16.098	+ 1.114
Bath Electric	*	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1.226	1.216	1.270	1.230	1.384	1.317	1.372	1.359	51½	71.202	+ 6.577
Birmingham Corporation	12.514	12.497	12.344	12.550	14.604	14.650	15.323	15.298	52	749.962	+117.754
Birmingham Motor Omnibuses	653	649	652	668	687	695	737	731	—	42.501	+ 19.752
Blackburn Corporation	1.014	1.055	1.115	1.052	998	1.041	985	1.057	51½	63.629	+ 95
Blackpool and Fleetwood	366	286	257	284	325	294	256	262	12	3.709	+ 65
Blackpool Corporation	861	581	552	574	930	683	622	646	52	78.153	+ 3.324
Bolton Corporation	2.548	2.547	2.466	2.416	2.585	2.503	2.576	2.542	52	138.423	— 30
Bournemouth Corporation	1.816	1.870	1.807	1.755	1.729	1.802	1.743	1.849	52	107.845	+ 5.324
Bradford Corporation	5.545	6.418	5.714	5.810	5.699	5.655	5.813	6.495	52	329.766	+ 13.107
Brighton Corporation	800	835	832	811	857	807	913	848	52	55.254	+ 1.191
Bristol	8.684	8.518	8.513	8.682	8.694	8.622	8.700	8.779	12	108.987	+ 7.781
Burnley Corporation	1.449	1.409	1.388	1.386	1.533	1.503	1.473	1.454	52	82.564	+ 3.494
Burton-on-Trent Corporation	264	254	245	248	222	235	248	242	52	14.596	— 459
Bury Corporation	1.270	1.268	1.243	1.194	1.275	1.193	1.227	1.212	51½	68.801	+ 402
Cardiff Corporation	2.461	2.392	2.403	1.554	2.569	2.471	2.634	2.614	51	138.838	+ 1.370
Chatham and District	976	996	1.022	1.012	951	975	1.019	1.042	12	12.286	+ 733
Chesterfield Corporation	241	249	245	248	241	249	246	257	51	13.711	+ 179
Colne Corporation	227	231	217	219	233	224	228	236	—	—	—
Cork Electric	437	457	481	441	423	418	417	456	12	5.297	+ 73
Croydon Corporation	1.608	1.564	1.622	1.678	1.439	1.462	1.564	1.628	51	91.800	+ 5.097
Derby Corporation	962	936	929	959	993	956	979	1.003	51½	53.800	+ 2.557
Dover Corporation	250	244	248	244	253	239	257	271	51	15.484	+ 2.347
Dublin and Lucan	113	109	149	120	102	106	120	100	12	1.343	— 58
Dublin United	5.422	5.441	5.921	5.521	5.584	5.539	5.913	5.495	12	69.489	+ 4.069
Dundee City	1.203	1.216	1.258	1.161	1.284	1.261	1.246	1.268	44½	60.373	+ 3.590
East Ham Corporation	1.227	1.237	1.243	1.259	1.150	1.115	1.167	1.174	51½	67.097	+ 5.377
Exeter Corporation	298	299	299	303	294	293	314	311	51	18.805	+ 1.044
Gearless Motor 'Buses	*	...	...	...	...	...	...	...	—	—	—
Glasgow Corporation	20.133	20.711	20.749	20.438	21.389	21.120	21.149	20.732	43	931.012	+ 69.697
Glasgow Subway	1.099	1.079	1.048	1.094	1.251	1.249	1.208	1.228	12	15.070	+ 1.855
Glossop (Urban Elec. Supply Co.)	108	107	101	110	127	113	122	124	13	1.657	+ 266
Halifax Corporation	1.801	1.875	1.967	1.933	1.730	1.906	1.699	1.952	50½	110.270	+ 704
Halifax Motor Omnibuses	...	44	43	43	...	33	24	31	50½	2.453	— 73
Hastings and District	704	707	844	744	643	649	735	691	12	8.583	+ 7
Huddersfield Corporation	2.248	2.326	2.329	2.401	2.578	2.468	2.543	2.540	51	136.734	+ 17.966
Hull Corporation	3.050	3.088	3.088	3.081	3.122	3.164	3.116	3.060	51	159.507	— 683
Ilford U.D. Council	576	557	563	563	588	586	610	612	51	33.007	+ 3.525
Ilkeston Corporation	114	114	116	110	117	116	119	123	52	6.942	+ 428
Ipswich Corporation	370	363	380	389	461	445	472	495	51	27.517	+ 4.965
Isle of Thanet	239	234	236	260	219	203	247	251	25	6.281	— 1.006
Kilmarnock Corporation	143	140	146	147	153	145	146	145	45	7.484	+ 317
Lanarkshire	1.635	1.747	1.726	1.711	2.065	2.032	1.976	2.097	12	25.332	+ 4.421
Lancashire United	1.483	1.579	1.527	1.542	1.498	1.563	1.475	1.550	12	18.693	+ 954
Leeds City	7.917	8.056	7.897	8.114	8.586	8.431	8.549	8.657	52	460.370	+ 37.579
Leicester Corporation	2.835	2.820	2.830	2.820	3.200	3.077	3.179	3.224	12	38.633	+ 5.001
Leith Corporation	631	648	650	657	713	715	745	735	45	34.459	+ 2.985
Leyton U. D. Council	1.500	1.487	1.551	1.501	1.337	1.373	1.415	1.466	51	80.954	+ 8.611
Liverpool Corporation	12.379	12.499	12.491	13.539	12.812	12.362	12.650	12.775	12½	159.451	+ 7.703
Llandudno and Colwyn Bay	246	192	189	203	170	179	185	190	16½	3.057	+ 40
London County Council	46.554	46.556	47.433	47.162	39.904	41.974	42.961	44.722	51	2.255.635	— 24.989
London General Omnibus	*	...	...	...	...	...	...	...	—	—	—
London United	*	...	...	...	...	...	...	...	—	—	—
Lowestoft Corporation	140	143	143	144	121	114	116	114	24½	3.199	— 944
Maidstone Corporation	158	163	168	162	152	155	163	172	51	10.760	+ 498
Manchester Corporation	16.259	16.449	16.319	17.517	17.125	16.876	17.019	17.092	51	914.470	+ 35.173
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	—	—	—
National Steam Car	*	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	150	152	148	151	176	184	178	177	51½	9.988	+ 757
Newcastle-on-Tyne Corporation	5.603	5.794	5.722	5.866	5.726	5.483	5.683	5.787	52	316.285	+ 28.393
Newport (Mon.) Corporation	751	741	742	754	822	782	840	828	52	43.546	+ 2.263
New St. Helens and District	859	897	874	908	841	855	827	834	38	37.974	+ 3.383
Northampton Corporation	671	660	685	714	646	632	640	662	51½	36.772	+ 5.611
Nottingham Corporation	3.129	3.308	3.507	3.408	3.501	3.566	3.516	3.694	51	190.200	+ 10.325
Oldham Corporation	2.124	2.009	2.097	2.038	...	...	2.176	2.128	52	120.661	+ 6.606
Portsmouth Corporation	2.106	2.096	2.124	2.082	2.045	2.098	2.113	2.047	52	124.689	—
Preston Corporation	837	852	842	849	955	910	904	949	51	49.869	+ 3.278
Provincial	1.888	1.890	1.926	1.919	1.911	1.886	1.948	1.891	25½	51.155	+ 3.229
Reading Corporation	642	647	660	669	708	711	699	734	51½	40.160	+ 4.305
Rhondda Tramways	952	1.135	1.072	1.201	1.124	1.122	1.149	1.196	12	13.818	+ 1.021
Rochdale Corporation	1.467	1.473	1.435	1.524	1.530	1.454	1.501	1.496	49½	86.234	+ 4.224
Rotherham Corporation	963	987	954	924	1.197	1.173	1.261	1.247	52	61.830	+ 9.172
Salford Corporation	4.803	4.673	4.907	4.677	5.020	4.819	4.935	4.902	51½	267.337	+ 13.054
Sheffield Corporation	8.086	8.182	8.088	8.077	9.529	9.060	9.529	9.711	52	476.789	+ 69.694
Southampton Corporation	1.193	1.174	1.216	1.195	1.373	1.386	1.371	1.399	51	76.185	+ 9.319
Southend-on-Sea Corporation	619	645	673	661	527	543	547	616	51	39.551	— 8.386
South Metropolitan Tramways	*	...	...	...	...	...	...	...	—	—	—
South Shields Corporation	668	685	716	708	734	702	707	713	51½	40.370	+ 2.035
Sunderland Corporation	1.267	1.352	1.296	1.302	1.411	1.487	1.458	1.455	52	77.761	+ 3.099
Sunderland District	508	532	556	494	543	504	525	531	21	11.728	+ 909
Swindon Corporation	163	159	168	169	166	167	169	180	51	9.945	+ 897
Torquay Tramways	347	423	449	451	363	376	388	414	12	4.838	+ 104
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	—	—	—
Tyneside Tramways and Tramroads	494	518	559	512	469	461	465	501	12	5.774	+ 192
Wallasey Corporation	1.053	1.049	1.046	1.096	1.103	1.034	1.076	1.095	51½	64.307	+ 1.686
Walsall Corporation	664	660	652	666	694	672	739	755	13	9.426	+ 1.279
Walthamstow U.D. Council	728	706	745	738	730	731	785	790	52	44.888	+ 4.186
Warrington Corporation	428	424	423	426	489	476	465	462	51	23.882	+ 1.728
West Ham Corporation	2.823	2.819	2.901	2.906	2.721	2.842	2.872	2.984	51½	157.157	+ 12.465
Wigan Corporation	1.405	1.415	1.379	1.394	1.499	1.511	1.480	1.489	51	77.685	+ 3.341
Wolverhampton Corporation	975	1.037	980	950	1.086	1.051	1.121	1.127	52	58.250	+ 3.831
Yorkshire (West Riding)	1.404	1.438	1.362	1.448	1.561	1.376	1.518	1.499	13	20.417	+ 2.011

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

THE TRAMWAY AND RAILWAY WORLD

can be obtained, post free, at the following rates:

For the United Kingdom—
Twenty-five Shillings per annum (including 64 issues, of which 12 are large illustrated numbers).

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The Choice of a Daimler by the largest users of Motor Lorries is based upon experience and the proven facts of its efficiency and economy.

Their records are evidence that the Daimler Maintenance Costs are the lowest known. This is the prime consideration for all prospective users, and is of imperative importance in single vehicle service.

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To the Daimler Co. Ltd.
Dear Sirs,

We have much pleasure in supplying two photos. of our Two-ton Lorry, and you may use either and retain both.

OUR EXPERIENCE of your chassis is that THERE IS NOTHING LIKE IT IN THE WORLD, and it never fails to take loads out and back without mishap. This has been our constant experience since the first day of running.

Yours cordially,
ARTHUR DAVIES & CO. LTD.

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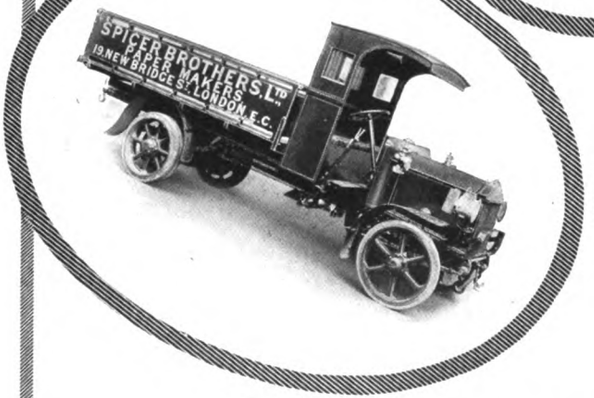
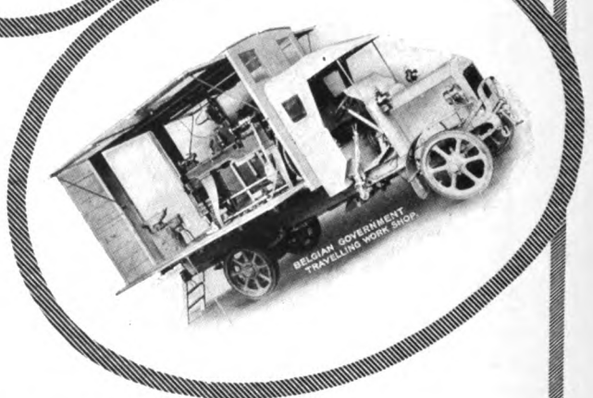
ENTIRELY BRITISH.





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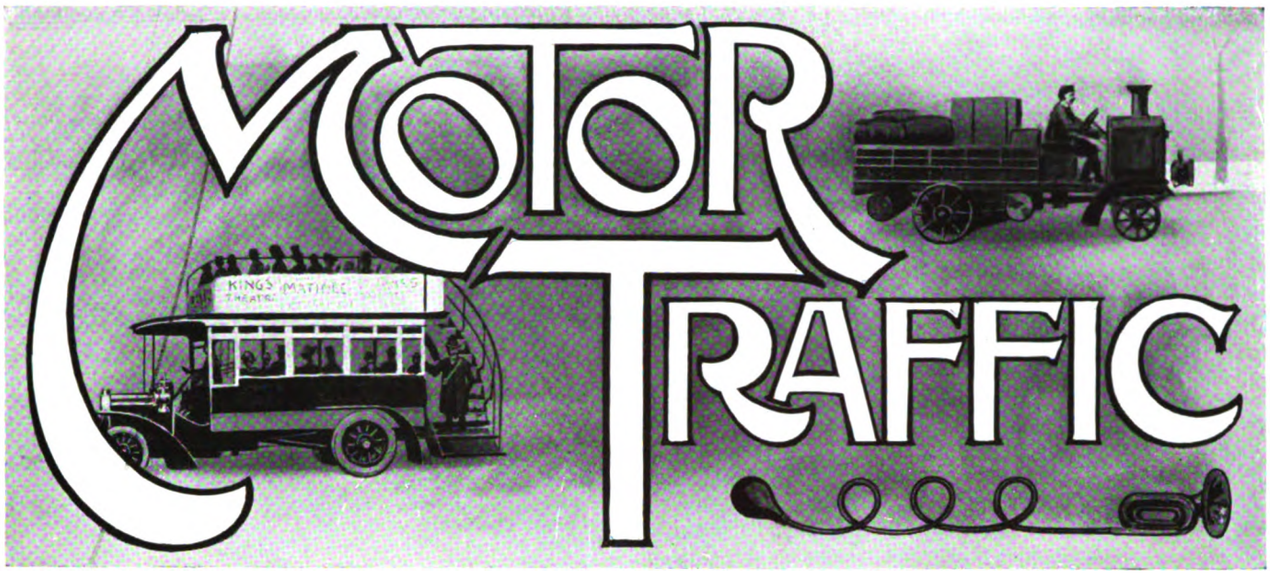

On various occasions during the war, and before it, attempts have been made to eliminate where possible some of the competition between the London County Council tramways and the omnibuses. So far, however, these efforts have met with little or no success, and much the same applies to those districts outside London which, although having a separate administrative existence, nevertheless are within the licensing jurisdiction of the Metropolitan Police. In London itself, however, the position is peculiarly awkward, and without exact parallel elsewhere. Originally the London County Council enterprise was confined to taking over existing horse-tramways and electrifying them. These horse-tramways ran over routes that had been recognised as their territory, and there was practically no competition. At a later stage, however, the London County Council began to extend into districts hitherto served by omnibuses. With continued horse traction the omnibuses could not have survived against their newer rivals for anything but a very short period. But matters did not thus resolve themselves. The electric tramways came and the motor omnibuses came too, and they have been running together on the same routes up to the present time. That this duplication of facilities is unnecessary, at least to some extent, there can be little or no question, but the difficulties in the way of getting rid of it seem to be, firstly, the fact that the "paralleling" occurs, as a rule, only on portions of established and useful services, and, secondly, the impossibility of any agreement as to whether the omnibus or the tramcar should give way. The omnibus interests, at all events, have a fair case on the ground of priority, but this does not seem to carry conviction in Spring Gardens, where a different point of view prevails. Hence the controversy goes on, and although there seems to be general agreement as to the desirability of an arrangement in the sense indicated, a workable formula does not readily present itself. Although so far as street traffic goes this problem is more or less peculiarly a London one, in other aspects it is not altogether non-existent in the provinces. Many of the longer journeys, both by omnibus and by tramway, are not justifiable from the undertakings point of view as regards revenue, or from that of the public as to the time occupied. Practically everywhere, in fact, where road transit services, other than purely local, are to be found, cases of this kind exist, and the aggregate effect of the waste mileage that is thus caused is sufficiently substantial in these times as to render helpful a general investigation on the question of eliminating redundant facilities to the utmost, not only in the Metropolis, but throughout the country.

* * * * * *

A fruitful source of waste in municipal operations is the practice of letting out haulage work to private contractors. In many cases it is defensible only on the ground that it has always been done in the past, and there has seemed to be no reason for making a change. That this sort of argument, in the long run, may become very costly, has been too often demonstrated to need any further insistence. Haulage accounts have a way of mounting up, little by little, into quite formidable annual totals, and it is only when they come to the notice of someone who is more than ordinarily alert that they receive any examination at all. In this way the practice of hiring often continues long after it has ceased to be economical, and until the municipality eventually discovers that it has been paying more for the use of a contractor's resources than would have been the case had it purchased its own vehicles outright—this after making all the necessary allowances in respect of depreciation, sinking fund, etc. Even in times before the war, discoveries of this kind were by no means infrequent, but during recent months, when the efforts of authorities have been directed to reductions in expenditure, with the result that there has been much closer scrutiny of outgoings than ever before, they have become much more common. For instance, one authority in the London area had been in the habit of hiring a steam wagon and trailer for use in its roads department, and the annual charge under this head was over £800. It acquired its own vehicles some time ago, and the result on the first year's working, including the interest and sinking fund on loan, is a saving of no less than £359. In addition, of course, the Council has all the advantages attaching to the ownership of the plant, and there is no reason, on the face of it, why the saving should not prove to be even more pronounced than now appears. Another influence that has made for an extension of ownership as distinct from hiring on the part of municipalities is that contractors, justifiably no doubt, have lately been asking greatly increased rates. Thus in a certain south coast town the Poor Law authorities, confronted with a 50 per cent. increase in the cost of hiring two motor vans, find that their annual bill in this respect would be increased to a sum more than sufficient to cover the purchase and maintenance of three similar vehicles of their

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MOTOR TRAFFIC.

own, after making full and liberal allowances in all necessary respects. Other cases have come to light recently, but the two described may be regarded as typical. They make it sufficiently clear that the practice of hiring vehicles for municipal service may too easily be continued long after purchase outright has become desirable.

* * * * * *

By no means the least striking feature of the London General Omnibus Company's enterprise is its methods of training its drivers and conductors. Through a course of instruction which, although comparatively brief, is thorough in the fullest sense of the word, both the driver or conductor is initiated in every detail of his (or her) duties, and prepared for any reasonable emergency that may arise therefrom. By these measures not only the company, but the public also, benefit. The one gains in the efficiency of its services and the better and more careful handling of its vehicles, while the other has the assurance that, so far as London omnibuses are concerned, nothing is left undone that can be done in the way of teaching and precept to secure the maximum degree of safety in the streets. There would be, of course, some difficulties in applying similar methods to undertakings on a smaller scale, but the excellent results afforded by the London General Omnibus training scheme render it intensely desirable that everybody engaged on public passenger vehicles should be given instruction that approaches as nearly as possible to that standard. It would, indeed, be salutary if the authorities were empowered to make this a condition in granting licences—that is to say, drivers and conductors should be required to undergo a definite training in public passenger work, and owners of omnibuses and chars-a-bancs should not be permitted to employ anyone without some certificate to this effect. Such a plan might be worked either by utilising existing garage or education facilities, or possibly both in conjunction, or, perhaps more appropriately, by the establishment of centres which might be maintained by public service undertakings in given districts. To these centres each undertaking in the area to be covered would send its drivers and conductors for a uniform general training course, any special details relating to the localities in which the men (or women) would eventually work being dealt with at the employers' own garage. A scheme of this kind would no doubt call for some care in organisation, but its difficulties should not prove insuperable, and the advantages that would result to the men themselves, to their employers, and to the public would be very considerable.

Motor Services in Bristol.—The motor department of the Bristol Tramways and Carriage Company have been notably successful during the past year, the traffic receipts having increased over 23 per cent. This department now earns more than the tramways department. The Avonmouth motor omnibus route has shown particular growth, and a much-needed service between Tewkesbury and Cheltenham has been inaugurated, but the opening of other contemplated services in Bristol and other districts was postponed during the war. The motor construction works at Brislington are doing good service in the construction of war munitions, including the making of aeroplane parts and fittings, and the construction and repair of motor workshops and lorries for the Army.

Poplar Council have been advised by the Electricity and Works Committee to purchase a 4-ton Edison accumulator wagon and a 4 ton Foden steam wagon, each with a tipping body, for the removal of ash and clinker from the electricity and destructor works.

MOTOR TRANSPORT YEAR BOOK.

From the office of the Electrical Press, Limited, Fisher Street, London, W.C., we have received a copy of the first annual issue of the "Motor Transport Year Book and Directory" (10s. 6d.). The publication is described as the companion volume to the "Manual of Electrical Undertakings and Directory," and we venture to say that it will be found indispensable to the owners and operators of motor transport undertakings and the trades connected therewith.

Doubtless much surprise will be occasioned, even to those who are closely associated with motor transport, when we mention that the geographical index to motor transport undertakings comprises 350 entries, including municipalities, companies and individuals. Besides public passenger transport, the services comprise pleasure traffic, but in this direction the list is naturally not complete. Nor is it possible even to furnish complete figures of the capital of the public service undertakings, but of the 350 such enterprises, 270 in operation have an estimated capital of about £7,500,000, and a total service of 6,300 vehicles. As is rightly stated in the preface, these figures would have been much larger if the war had not intervened to deplete existing motor services, by taking many of their vehicles for military work, and to prevent the formation of new undertakings.

An indication of the importance of the industry from a commercial point of view is given by the list of manufacturing and miscellaneous companies allied to motor transport services. To that list 93 of the 262 pages are devoted. The information under that heading includes particulars of constitution and objects, profit and loss account and balance sheet, comparative tables, chief officials and other details.

All this record of progress has been achieved in just under two decades since the Government of the day, stimulated by the progress of the motor car on the Continent, relaxed the law that required a man with a red flag to walk in front of a mechanical vehicle, and raised the maximum speed limit to 14 miles an hour, to be followed by 20 miles an hour under the Motor Car Act of 1903. In 1896, when the motor car run to Brighton was organised, the private car was still the butt for the wit of the horse driver. In referring to that run, which was not accomplished without mishaps to some of the vehicles, The Tramway and Railway World observed that "it would give a prodigious impulse to transport both by road and rail." To the motor omnibus of a few years later antipathy was even more pronounced, but the public passenger chassis has now reached a high degree of efficiency. No doubt after the war, as is observed in the introduction to the Year Book, "we may expect a renewal of progress towards economy and efficiency, and a rapid extension of motor services in rural and other districts." It is worth while recalling from the introduction already referred to, the directions along which the omnibus has made its way into public service, viz., (1) the replacement of horse omnibuses on existing services; (2) the development of inter-urban and rural services, either in connection with railways or independently; (3) the supplementing of tramway services along busy routes; (4) the feeding of tramway, railway ("tube" and other) services by the provision of motor omnibus facilities over new routes; (5) the establishment of motor omnibus services in small towns.

An article of paramount interest to those engaged in public passenger transport is contributed by Mr. T. C. Elder. It is entitled "Public Service Motor Policy in 1916." He suggests that it will not everywhere be possible for the motor omnibus interest to settle down to enjoy its share of the people's pennies, and that the American "jitney" competition, which has become a bugbear to the street railway service, has already begun in this country to offer the public a quicker run from point to point in vehicles that give "more of the flavouring of real motoring." But he predicts that established undertakings "will use to the full the advantages of their financial and administrative power," and that "it is part of their business to be always thinking what they can do next, and what they can do better." The author makes no reference to the possibility of pneumatic tires for omnibuses being available before long. Success appears to be attending experiments in that direction in the U.S.A., for we observed the other day in an American automobile journal an illustration of a 2-ton pneumatic-tired tower wagon.

Other features of the volume include a survey of the Acts relating to motor omnibus services, the law for the common carrier, the taxation of motor spirit used by omnibuses, Development and Road Improvement Funds Act, 1909, the Road Board, lights on vehicles (including the special regulations under the Defence of the Realm Act), the principal associations connected with the industry, etc. One of the most valuable sections is a directory of 2,000 officials connected with the motor transport undertakings and allied manufacturing companies.

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MOTOR TRAFFIC.

BIRMINGHAM CORPORATION GARAGE.

TRANSPORT PROVIDED FOR COMMITTEES AND OFFICIALS AT A PROFIT OF £608 IN TWO YEARS.

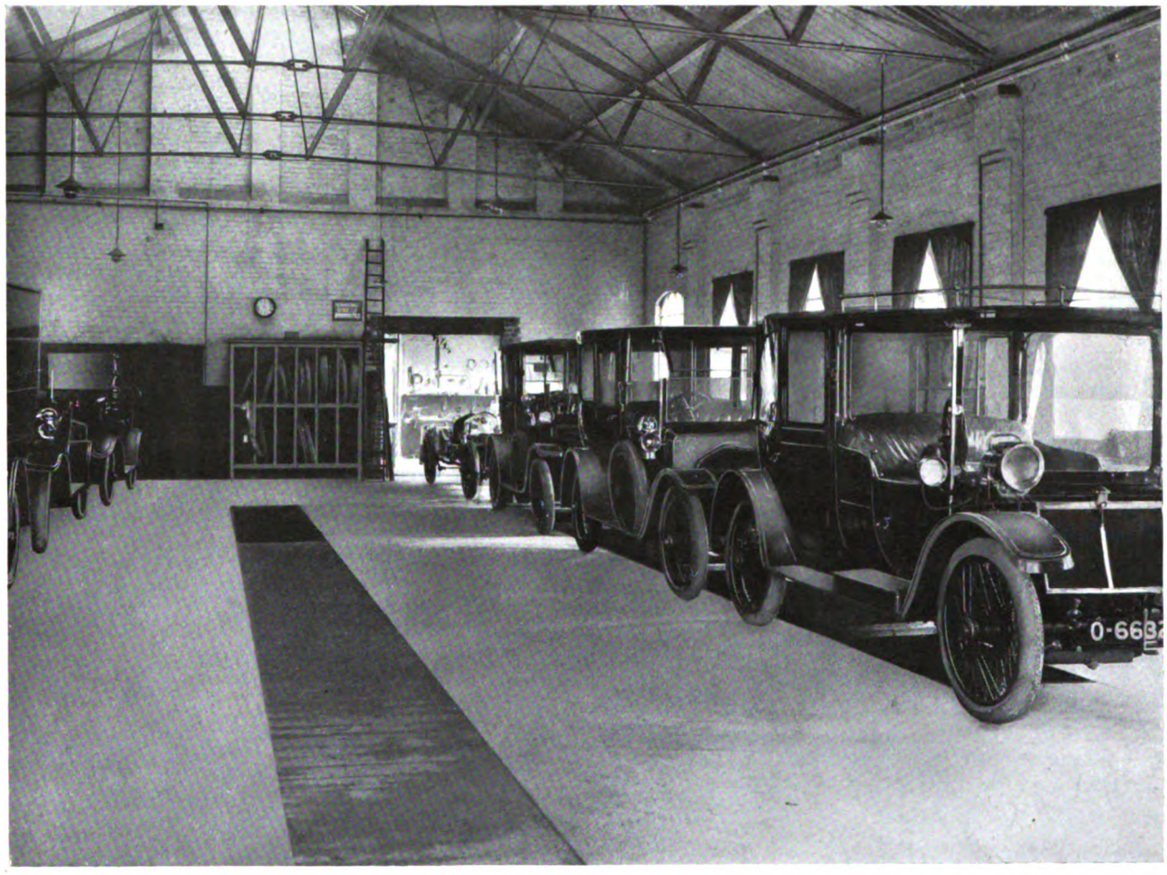
Even amongst the smaller local governing authorities a considerable expenditure is entailed by the provision of means of transit for members of committees and officials, in order that they may the more expeditiously discharge their duties. For this work motor vehicles are now invariably used, but there are numerous towns that have not yet advanced beyond the plan of hiring the motor cars, either by the journey or the year. That system was reasonable enough in the early years of motor traction. Other Corporations have long recognised the wisdom of owning the cars, but they have not yet all adopted a central system of garaging the vehicles. In some places there is such a marked want of method as to permit various committees to maintain their own cars, instead of having a common garage from whence the various departments can obtain conveyances. Instances may also be cited in which a central garage has been provided, but the working of it has not given satisfaction owing to the want of competent management.

Such a result as the latter can easily be avoided in places where there is a municipal tramways undertaking. In this connection the experience of Birmingham Corporation is of importance. It was on April 30, 1913, that the Hockley garage was handed over to the care of Mr. Alfred Baker, the general manager of the tramways department, to whom we are indebted for the accompanying photographs of the garage and some of the cars. The stock received from the various departments of the Corporation comprised 13 cars, only six being at that time in good condition. Now with one exception they are all in that state, a result that has been achieved only by overhauling. The one unfit car is obsolete.

Working on the reasonable charges of 6s. per hour and 5d. per mile for first-class cars, and 5s. 6d. per hour and 3d. per mile for second-class cars, the financial results have been exceedingly satisfactory. In an undertaking of this nature the object is not to make a show of profits, but to place speedy and always accessible transit facilities at the disposal of committees and officials. The extent to which Mr. Baker has accomplished that task, working with second-hand cars, may be judged from the fact that during the year ended March 31, 1915, the garage attended to 2,310 telephone calls for cars. Upon 18 occasions the cars were requisitioned for Sunday work.

As to the financial aspect, the garage returned a profit of £366 for the first 11 months' working, while last year the balance was £242. These results were attained "after charging all proper expenses, including the requisite amount for the depreciation of each car as fixed by the General Purposes Committee," who presumably were previously in charge of the garage. The total credit balance of £608, Mr. Baker recommends, should be used for the purchase of two additional cars, and he expresses a preference for landaulette cars, similar to taxi-cabs, which could be used either open or closed.

Since the outbreak of the war the various committees, notably the Finance and Health Departments, have considerably reduced their calls for cars, and in August last the service was nearly suspended, owing to the uncertainty of the petrol supply, the greater part of the spirit ordered for the garage being handed over to the fire brigade. Apropos of fuel, considerable use was made of benzol during 1913–14, and more mileage was obtained than by the use of petrol. Despite that fact, Mr. Baker does not recommend the general use of benzol, "as the advantage gained was more than counterbalanced by lost journeys through carburetter and other troubles." This is a matter to which further attention should be devoted, for given the right type of carburetter the use of benzol generally proves beneficial.



Birmingham Corporation Garage, Maintained by the Tramways Department.

The cars, their mileage since April 30, 1913, and the departments from which they were taken over are shown in the following list:—Lanchester, 3,212 miles, two Alldays, 8,134 and 6,233 miles, Humber, 9,917 miles (Tramways); Daimler, 6,732 miles (Estates); Allday, 7,803 miles (Finance); Wolseley, 5,578 miles (Public Works); Sunbeam, 3,365 miles (Gas); Wolseley, 7,202 miles (Electric Supply); Star, 8,954 miles (Weights and Measures); Rover, 2,524 miles (Gas). The Humber car is described as still running very well, despite its age—7½ years. The appended table shows the total

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mileage of the cars and the petrol consumption during the year ended March 31, 1915 :—

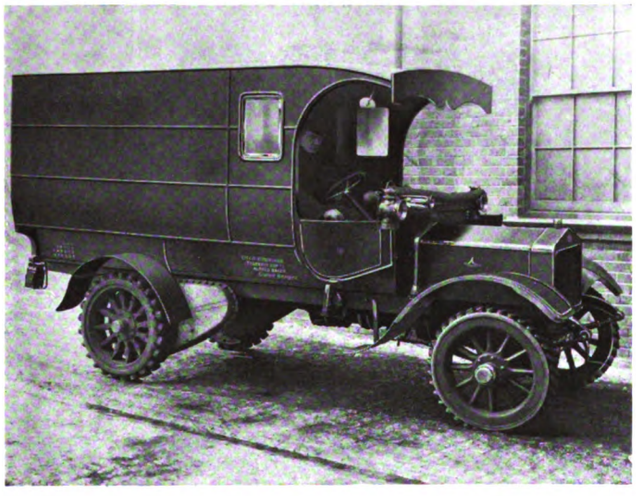
1914.	Miles Run.		Total Mileage.	Petrol Consumption —Gallons.		Total Gallons.
	1st Class.	2nd Class.		1st Class.	2nd Class.	
April	1,351	4,592	5,943	127	386	513
May	1,776	5,410	7,186	125	419	544
June	1,819	4,795	6,614	159	404	563
July	1,473	5,623	7,096	145	440	585
August	711	1,759	2,470	71	148	219
September ...	1,324	4,273	5,597	148	367	515
October ...	2,023	4,684	6,707	193	407	600
November ...	1,637	3,489	5,126	152	472	624
December ...	1,457	4,049	5,506	171	583	754
1915.						
January... ...	1,953	4,139	6,092	240	524	764
February ...	1,602	3,800	5,402	182	433	615
March	2,049	3,866	5,915	207	369	576
Total ...	19,175	50,479	69,654	1,920	4,952	6,872

Subjoined is a table showing the mileage obtained per gallon of petrol by each car :—

	Miles.	*Miles per Gallon.*
Lanchester	3,212	... 10¼
Allday	8,134	... 12½
Allday	6,233	... 13
Humber	9,917	... 12¼
Daimler	6,732	... 8¾
Allday	7,803	... 9¼
Wolseley	5,578	... 11
Sunbeam	3,365	... 7½
Wolseley	7,202	... 11¼
Star	8,954	... 12
Rover	2,524	... 17½

The foregoing table, the general manager remarks, "must not be taken seriously, as all these cars would do more mileage per gallon if taken out specially for consumption. It must be taken into consideration that the amount of petrol used includes testing the cars and other items that occur in daily use of cars. New chauffeurs do not tend to lower the consumption. Five of the drivers are with the colours, and it is a difficult matter to secure experienced men. At present we are slightly understaffed."

As regards tires, the Palmer cord tires and the Kempshall are being used. Both have a guarantee of 5,000 miles, but the latter

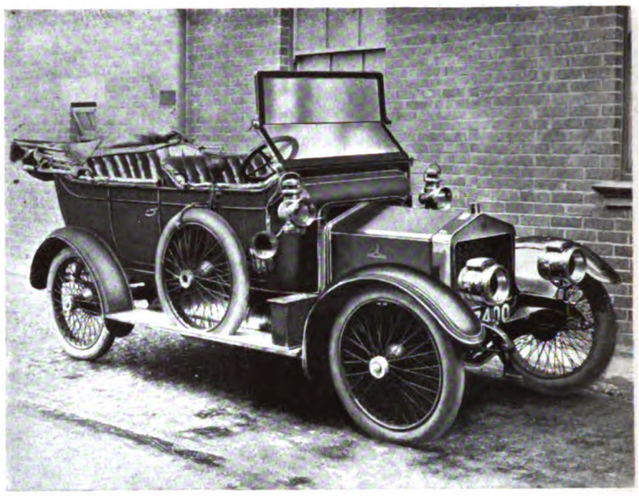


Alldays Van of the Tramways Department.

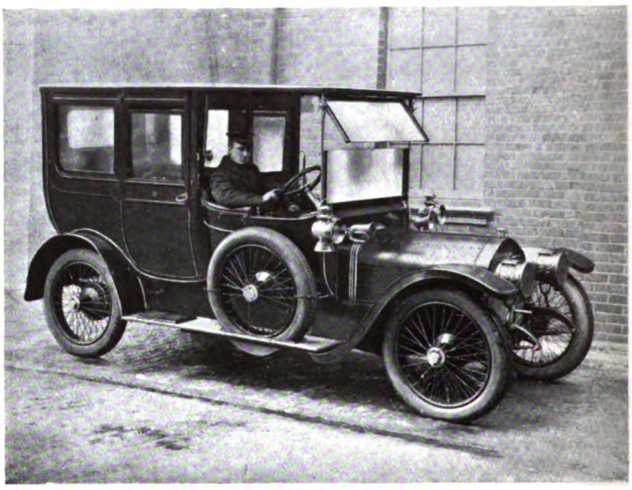
are described as being cheaper. The Kempshall, with its non-skid devices, will be seen in the photograph of the car belonging to the Tramways department.

Judged by two items in the balance sheet, the 13 cars belonging to the garage are plainly insufficient to meet the demands for the use of vehicles, for included in the expenditure was £708 for the hire of taxi-cabs and £60 for the hire of private cars. Thirty-three departments of the Corporation, including the police and city justices, made use of the cars.

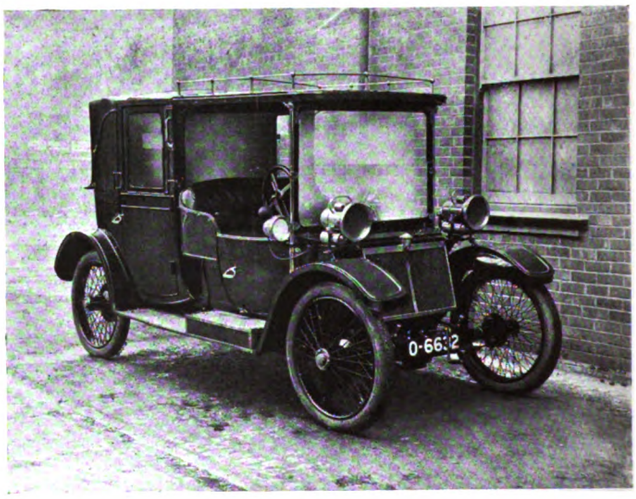
To the Tramways department the utility of motor cars was very great, both for committee and commercial use, long before the



Alldays Car.



Wolseley Car.



Lanchester Car.

Some Types of Cars Owned by Birmingham Corporation and Garaged by the Tramways Department.

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MOTOR TRAFFIC.

supervision of the garage was handed over to Mr. Baker, the department having originally owned four vehicles. The greatest use of the garage during the year 1914–15 was made by this department, which paid charges amounting to £1,225. Next in order was the Gas department, £981, the Police and Justices, £429, the City Treasurer and Rating department, £388, and the Electric Supply Committee, £302. Excluding a sum of £699 allowed to the various departments as depreciation on the transfer of their cars to the garage, the total receipts for the use of cars was £4,371.

The following abridged table shows the age, original cost, the annual amount allowed for depreciation, and the written-down value of each car :—

Type of Car.	Date Acquired.	Original Cost.	Annual Depreciation (¼ of original cost).	Written-down Value, March, 1915.
1st Class Cars.		£	£	£
20 h.p. Lanchester	Aug., 1911 ...	648	92	308
20/28 h.p. Wolseley	May, 1911 ...	734	104	323
16/20 h.p. Sunbeam	April, 1912 ..	622	88	355
16/20 h.p. Wolseley-Siddeley	May, 1912 ..	599	85	349
2nd Class Cars.				
14/18 h.p. Alldays & Onions	Feb., 1912 ...	309	44	169
,, ,, ,,	,, ,, ...	309	44	169
15 h.p. Humber	Dec., 1907 ...	369	53	—
15 h.p. Daimler	March, 1912	482	68	270
16/20 h.p. Alldays & Onions	Aug., 1912 ...	357	51	221
15 h.p. Star	July, 1912 ...	384	54	233
8 h.p. Rover	Jan., 1910 ...	203	29	51

Income, May 1, 1913, to March 31, 1914.

Hire of motor cars :—			
First-class cars—			
18,279 miles at 5d. per mile ...	380 16 3		
3,463¼ hours at 6s. per hour ...	1,038 19 6		
		£1,419 15	9
Second-class cars—			
53,217 miles at 4d. per mile ...	886 19 0		
7,865·54 hours at 5s. 6d. per hour	2,163 0 6		
		3,049 19	6
		4,469 15	3
Hire of taxi-cabs (*per contra*) ...		228 17	8
Hire of private motor cars (*per contra*)		17 19	5
		£4,716 12	4

Income, Year ended March 31, 1915.

Balance brought from last account		£366 8	7
Hire of motor cars :—			
First-class cars—			
19,175 miles at 5d. per mile ... 399 9 7			
3,820 hours at 6s. per hour ... 1,146 0 0			
	£1,545 9 7		
Second-class cars—			
14,796 miles at 4d. per mile ... 246 12 0			
35,683 miles at 3d. per mile ... 446 0 9			
7,508 hours at 5s. 6d. per hour 2,064 14 0			
	2,757 6 9		
	4,302 16 4		
Contributions for superannuation, 1909 scheme	17 18 7		
	4,320 14 11		
Hire of taxi-cabs (*per contra*) ...	707 17 5		
Hire of private motor cars (*per contra*)	59 19 8		
		5,088 12	0
		£5,455 0	7

Appended is a copy of the items of expenditure for the two years ended March 31, 1915 :—

Expenditure.	Year ended March 31, 1915.	May 1, 1913, to March 31, 1914
Wages of chauffeurs and cleaners...	£1,169 5 4	£1,224 9 0
General management	440 12 0	395 9 5
Petrol	421 18 0	442 1 7
Lubricants and cleaning materials	49 5 8	76 8 2
Tires and tubes	307 2 1	436 5 11
Tools and Sundries	4 15 10	48 7 6
Repairs	365 0 11	248 8 6
Uniforms	83 0 8	49 11 9
Printing and stationery	22 0 2	37 5 2
Licenses and Insurances	211 8 10	219 6 7
Rents, rates, etc.	174 0 0	160 15 0
Lighting, heating, water and cleaning garage	114 15 5	107 19 10
Depreciation	699 2 1	656 18 3
	4,062 7 0	4,103 6 8
National Insurance Act, 1911 ...	7 7 10	—
Allowances to employees O.H.M.S.	9 0 0	—
	4,078 14 10	4,103 6 8
Hire of taxi-cabs (*per contra*) ...	707 17 5	228 17 8
Hire of private motor cars (*per contra*)	59 19 8	17 19 5
	4,846 11 11	4,350 3 9
Balance	—	366 8 7
For year ended March 31, 1915	242 0 1	—
For 11 months ended March 31, 1914	366 8 7	—
	£5,455 0 7	£4,716 12 4

TILLING-STEVENS PRIVATE OMNIBUS.

The Mental Hospital Authority of Croydon are using a 2-ton petrol-electric chassis fitted with a saloon body, both supplied by Tilling-Stevens, Limited, of Victoria Works, Maidstone. This chassis, which is gear-driven, is a light commercial type of the well-known machine that has for years given low working costs in public passenger transport in London, Birmingham, and other cities at home and in the Colonies. Its record is equally satisfactory in commercial use.

A Tilling-Stevens Private Omnibus.

The Croydon vehicle is used for the conveyance of patients to and from the hospital and the railway station, and also for the members of the committee of management. It has seating accommodation for ten passengers, the seats being arranged in the same manner as in the London omnibus type of Thomas Tillings, Limited, with a rear entrance. A ladder is provided to enable luggage to be carried on the top. Acetylene is used for the lighting of the interior and also of the head lamps.

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MOTOR TRAFFIC.

TRAINING SCHOOL OF THE LONDON GENERAL OMNIBUS COMPANY.

"Things are not what they were when you were a child. Things are a good deal faster, and among other things the traffic in the streets." These are the words of warning with which a little leaflet on "Safety," issued by the London General Omnibus Company, is introduced. It is to the credit of the company that it has contributed more than any other agency to make travelling in London faster, and it is doing all that can possibly be done not only to make such travelling safer for those who travel, but to reduce its danger to all those who use the streets. The work is begun by the careful and systematic training of its own employees. Every tramway and omnibus undertaking makes some effort to train its men; but it is one of the advantages of a large and prosperous organisation that it is able to make more thorough provision for the purpose than would be possible were the business on a smaller scale. There is probably no other school of the kind that can compare in extent and equipment with the school that the operating department of the company has established in Milman's Street, Chelsea. Here under the supervision of Mr. H. E. Blain, the operating manager of the London General Omnibus Company and the "Underground" companies, an establishment has been organised and admirably equipped with everything needed to assist in the training both of motor omnibus drivers and conductors. The premises were originally a stable used in connection with the horse omnibus business, but in the latter part of 1913 they were converted to the present use. How great was the need for the school is shown by the fact that

Learning to Drive.

within the first year after it was opened 2,140 new drivers, 528 conductors, and 91 inspectors passed through the classes. In the second year the corresponding figures were 928, 521, and 83. At the present time the company has over 7,000 drivers and conductors, a reduction of 3,000 from the number before the war.

The school in which the training of all the employees is carried out has an area site of 31,050 square feet, including an open yard of 5,396 square feet in which are placed various hazards, such as refuges, pedestals, etc. This yard is used by the drivers for practice in steering and the manipulation of the omnibuses until they have acquired sufficient skill to drive in the street.

The buildings comprise five class-rooms, a cinema hall in which illustrated lectures are given, mess-rooms, a small covered yard, and office accommodation.

Before a candidate is admitted to the school, he must undergo strict examination. This is particularly stringent in regard to sight and hearing, and men who find it necessary to use spectacles are not accepted. The minimum height measurement is 5 ft. 6 in., and drivers under 25 or over 40 years of age are not eligible. After the men have been accepted for tuition, they are allocated to garages as near their homes as possible, but before beginning service they are put through the initial stages of their training at the training school. Here the most capable and experienced drivers in the employ of the company are utilised as instructors. Some of these, with special learners' omnibuses, are also attached to the various garages, of which there are 26.

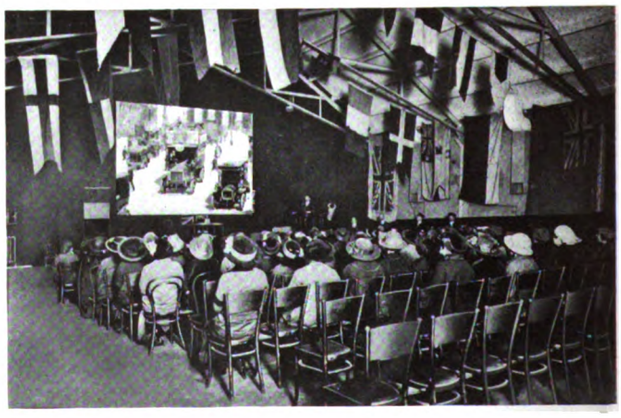
At the training school lectures are given on the mechanism and control of the vehicles, together with practical instruction and drill. Actual driving is first attempted on the school premises under the tuition of instructors, and subsequently in quiet neighbourhoods, where there is little traffic. When sufficient progress has been made,

Drivers' Training Yard.

the learners are taken into streets with heavier traffic, and by degrees the necessary dexterity and confidence needed for ordinary service is acquired. In the meantime the drivers have become familiar in the lecture rooms with the various parts of the chassis, which are shown there. In one of the rooms an actual section through an engine is exhibited. In this way a knowledge of the equipment is obtained, and the drivers are taught to remedy slight defects without having to send for assistance.

In the cinema hall, which has accommodation for about 400, lectures are delivered on the actual conditions of service working, and these are enforced by a series of films specially taken with a view to showing the learners the right and the wrong way of carrying out their duty under a great variety of circumstances. Special stress is laid upon the importance of safety. The rule of "safety first" is continually emphasised, and points in connection with the avoidance of accidents are clearly discussed.

The value of the cinematograph as used at the school is noteworthy. The series of films are excellently arranged, and they enforce the instructions of the lecturer as nothing else could do. It would be most useful if the public as well as drivers and conductors could see them. The public are proverbially careless, and the danger which is incurred by their heedlessness could not be more forcibly impressed upon them than by the hair-breadth escapes shown in some of the pictures.



The School's Cinematograph Theatre
(Women Applicants for Conductors' Positions).

After learning what the cinematograph can teach him, completing his training in the school, and having satisfied the instructors as to his capability of driving vehicles, the learner is finally tested by one of the chief instructors, and is then submitted to Scotland Yard.

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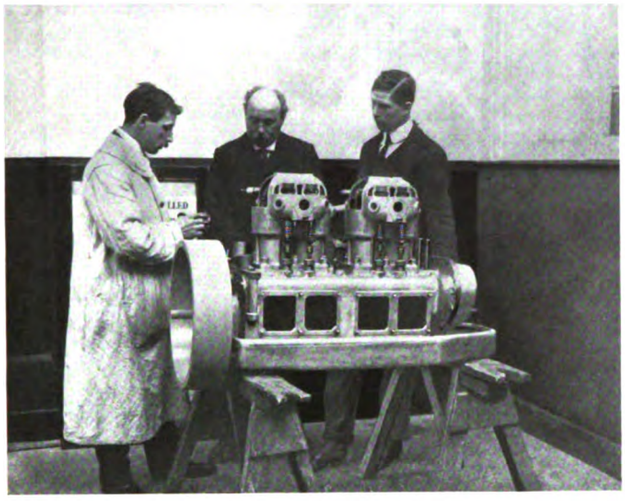
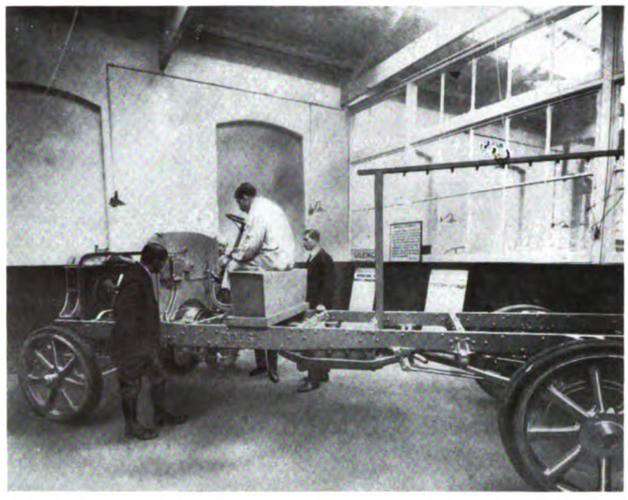
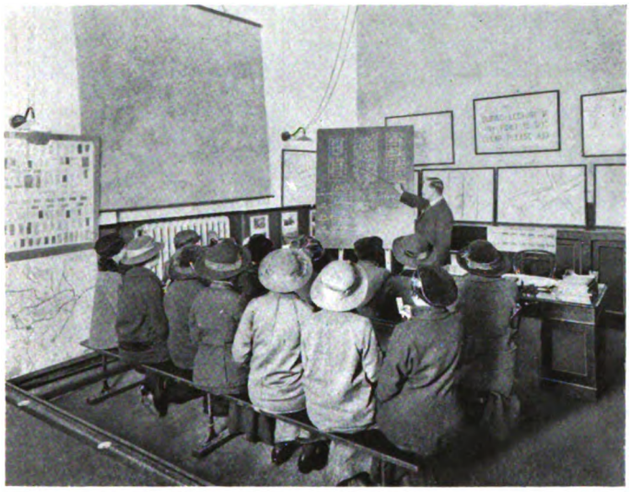
MOTOR TRAFFIC.



Instruction in Details of Engine.



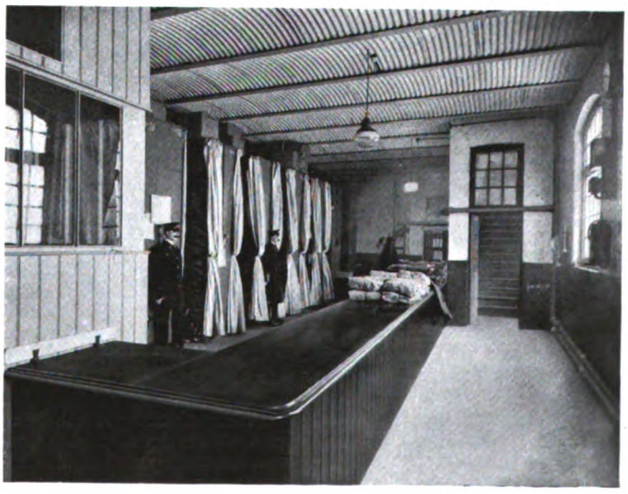
Explanation of Chassis Design.



Training Class for Women Conductors.

Male Conductors' Instruction Class.

Tailors' Shop.



Uniform Distribution Store.

LONDON GENERAL OMNIBUS COMPANY'S TRAINING SCHOOL.

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MOTOR TRAFFIC.

police test. This test includes an examination in a short-arm reverse and actual driving through the busiest West End thoroughfares. The average driver becomes fully competent in 28 days from the time of entering on his training.

Conductors, who must not be less than 5 ft. in height or under 21 years of age, are also given a thorough course of training. While the medical test is not so severe as in the case of the drivers, an examination is insisted on, and no one is employed unless physically sound in all respects. Learners are taught the operation of the punch and the handling of tickets. The fare stages are explained, and other parts of their duty are discussed in lectures, including avoidance of accidents and care for the safety of passengers. They are also shown cinematograph films specially arranged for their instruction. They are allocated to garages, and begin their service with an experienced conductor in order to obtain facility in the work before taking charge of an omnibus. A conductor generally completes the training in 14 days.

and the receipts for the current year will probably reach £24,000. At ten of the mess-rooms there are commodious and well-appointed billiard and recreation rooms, some having from two to three hundred seats.

During the past year the school has been extensively used for training purposes outside the company's requirements, and for the training of army drivers. Large numbers of women have been trained as conductors, and many of them are now giving very satisfactory services on the omnibuses. The shortage of men has, of course, made it exceedingly difficult to maintain the services, and it is surprising how fully the company has succeeded in meeting the needs of the public during a period of unexampled stress.

Not only is the London General Omnibus Company ensuring safety by carefully training its employees, but, as reported in another column, it is taking measures to instil into the minds of every man, woman, and child how necessary it is that they should regard "safety first." "Is it safe?" is the question which is

L.G.O.C. Training School—Women Conductors about to Leave the Yard for Training on the Road.

Inspectors are promoted from the staff, and they attend at the training school for examination in their new duties, particularly in connection with their relations with the public and the staff.

The clothing store, which adjoins the training school, is also under the control of the superintendent of employment. A competent tailor is in charge of the section, and is assisted by a staff of six storekeepers, clerks, and women tailors. All uniform clothing necessary for the company's drivers, conductors, and inspectors is here dealt with, that is, the materials are received and stored, the uniforms are made, issued, and recorded. The measurements of the staff have been co-ordinated into twenty stock sizes, an arrangement which does away with the difficulties of measurement of so large a number, promotes economy, and saves much time. As many as 600 men have been supplied and fitted with well-tailored suits in one day, and out of a total issue to 10,000 men, only 20 remained which required alteration.

The school building also provides accommodation for the headquarters of seventeen mess-rooms and institutes, which have been set up in connection with the garages on terminal points in different parts of London, where special arrangements have been made to enable the employees to purchase refreshments at practically cost price, the company bearing the expense of rooms, lighting, etc. During the year 1915, no less than 1,900,000 purchases were made,

everywhere to be asked. It will make its appeal from the stairway of every omnibus and from the columns of daily newspapers. Warning leaflets are being distributed broadcast, and they should form an effective item in the salutary campaign for inculcating caution which Mr. Blain and his colleagues are carrying on.

THE PETROL-ELECTRIC CARS FOR DUBLIN AND BLESSINGTON TRAMWAYS.—Mr. T. H. Richardson, who presided at the half-yearly meeting of this company, said the two electric cars which were ready for delivery by the contractors were taken by the Government, and this was repeated with six different equipments. The result was to deprive the company of these cars during the four best months of the year. It was extremely difficult, if not impossible, to get materials for the repair of the steam engines. The net profit was £188, as against a loss of £566. The guaranteed dividend of 5 per cent. per annum was ordered to be paid. A case has been submitted to counsel against the application by the County Councils of Dublin and Wicklow to take over the railway, towards which the shareholders subscribed in ordinary shares £58,000.

THE DUNLOP RUBBER COMPANY of Australasia have completed the installation at Melbourne of what is described as the finest motor and cycle tire manufacturing plant in the Southern Hemisphere.

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MOTOR TRAFFIC.

L.G.O. EMPLOYEES AS SPECIAL CONSTABLES.

ADDRESS BY SIR ALBERT STANLEY.

An interesting ceremony took place on March 18, when Sir Albert Stanley, managing director of the Underground Railways and London General Omnibus Companies, inspected at the Cricklewood garage the employees of the London General Omnibus Company who are serving as special constables in the Metropolitan Police. The detachment, which comprises about 436 men, of whom 360 were on parade, is divided into four sections, stationed in various districts of London, the duties consisting principally of guarding the property and garages of the company, many of the latter at the present time being utilised by the military. Mr. W. F. Rainforth, the commander, was in charge of the arrangements, and attended Sir Albert Stanley during the proceedings, and Mr. J. P. Thomas, assistant commander, led the march past.

London General Omnibus Men as Special Constables.

Sir Albert Stanley inspected the lines, and took the salute as the men marched past to the music of the L.G.O. Band, conducted by Mr. W. G. Heath. Among those present were Mr. H. E. Blain, Mr. W. E. Mandelick, Mr. D. McInnis, Mr. A. Moss, Mr. G. Rushton, Mr. A. Crane, Mr. R. Johnson, Mr. E. R. Beaty, and Mr. J. P. Thomas.

Sir Albert Stanley, in the course of an interesting address, said that coupled with his pleasure at being present was his admiration for the way in which the men had drilled. Mr. G. H. Harding and others who had worked hard to bring this about were entitled to a great deal of praise. After all, however, it was no more than they expected from the men of the London General Omnibus Co.

The Company's Aid to the Government.

Immediately war broke out representatives of the War Office and the Admiralty told the company that they required their services in certain directions. He replied, as he knew each and every man in the service would have him say, that the whole resources of the company were at the disposal of the Government, and that whatever they needed would be done by the men so far as it lay in their power. It had been recorded, and would go down for all time, that whatever work the L.G.O.C. was called upon to do—whether it was to supply men for a particular purpose, or the vehicles which were so sadly needed at the beginning of the war—the company did not fail. The Government took from them a great many omnibuses, and, be it said with pride, a very large number of their men. Notwithstanding the vehicles were not adapted to the particular purpose for which they were required, and were tried far in excess of what they were originally designed for, it was found that they were built true and had stood the test. The war had brought to them all very many problems, which had succeeded one another with rapidity, and it seemed that before they had come to the solution of one they were confronted with another. Those whom he addressed were identified with a very large undertaking, representing in one form or another capital of some 60 to 70 millions. It had in its service, in normal times, something between 25,000 and 30,000 men, and in ordinary conditions it dealt directly with something approaching 1,000 million people every year. Although working in a very concentrated area, the undertaking formed an essential part of the welfare of the nation. Their problems might be divided under three heads, viz., (1) to arrange matters so that every possible man who wished to join the Forces should be allowed to do so; (2) to maintain from their factory at Walthamstow the needs of the War Office both with respect to motor chassis and the maintenance of the large fleet already gone; and (3) the maintenance of the transport service adequate to meet the needs of London. Whatever part each one of them was taking under those headings it was a part of which they would be proud when the nation was at peace again. They had heard from time to time what the company's men were doing at the front, and it was a source of great pride to all that the men were responding so nobly. Although they had had many problems to deal with, he had no doubt that before them were problems of even greater magnitude. But if these were met by all connected with that undertaking in the same spirit as had been shown in the past, he had no fear but that they would arrive at a solution of each and every one of the problems that would be satisfactory to all.

Sir Albert Stanley Received by the Officers.

Mr. W. F. Rainforth. Mr. J. P. Thomas. Mr. Courtney. Mr. Clark. Mr. J. G. Shave. Mr. Lansdown.

Harmonious Attitude on Labour Problems.

To the accredited representatives of the men who were dealing with the labour problems, he would like to say that they had met the company in each and every instance fairly, and had arrived at a conclusion fair alike to everybody concerned. So long as they worked together in that spirit he had no fear for the future. Not the least of the problems was that of women labour. Women had come into various grades of service and fields of labour that were not contemplated a few months ago. It might be, as time went on, that they would have to depend more and more upon women. Those who had already come into their service were doing their work faithfully and well. To the men who were instructing and advising the women in their new duties he would say that they were

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MOTOR TRAFFIC.

tackling the problem in exactly the same spirit. Everywhere, so far as he knew, the women had met with courtesy and with a desire to ease their burdens as much as possible. He thought they would all wish him to thank these women for helping them in this great emergency, and when the men whose places they had temporarily filled came back, it would be a source of satisfaction to all to know that they had come forward and done their duty. Not the least of the duties of those who, for physical reasons, or because of circumstances connected with their employment, were unable to fight was the succouring of the wives, children, and other dependents of those at the front. For this purpose a special committee called the T.O.T. had been set up, and upon this were representatives of the various grades of service ranging from the directors right through the ranks. The men who had gone away had the satisfaction of knowing that when they came back they would not only find their positions waiting for them, but that their homes had been maintained. He took this opportunity of publicly thanking every member of the T.O.T. and the various sub-committees for their assistance in this connection. Sir Albert remarked that although he could not see the employees of the company often, he was confident that the officers who had to deal with the various problems affecting their interests took the same view as he himself would take. His deep personal interest in the welfare of the servants of the company, and of the women as well, was shared to exactly the same extent by the officers to whom were delegated very important duties. They had, he felt sure, established in the mind of every man the knowledge and belief that so long as he was in their service he was going to get a square deal. Theirs was a big undertaking, and they had big interests. They had to consider the interests of the shareholders, the interests of the public, and the interests (by no means the least) of every man engaged in the service. The companies had found it necessary to organise and consolidate in order that their interests might be protected, but the enlargement of their sphere of operations carried with it additional burdens and responsibilities. The public demanded more and the companies must give more. They had to establish a sound measure of credit to get the capital wherewith to carry on their enterprise, and the men perhaps felt that their interests in these big combinations demanded more than was the case in other circumstances. His view—a view shared by his colleagues—was that unless a fair wage could be paid to every man in their service, they should be free to find employment elsewhere. While it was true that combinations of capital carried increased responsibility, the same was also true of combinations of labour. He believed in the organisation of labour, but he was also a believer in the accredited representatives of organised labour recognising that there were two sides to the problem. It afforded him genuine pleasure to be able to say that in the negotiations between the company and the representatives of the men the problem had been approached in a fair, broad-minded spirit and with a desire to secure harmony and understanding. So long as this continued he had no fear that any serious misunderstanding would arise, and, speaking for himself, so long as that friendly spirit continued they would find that the company would be prepared to meet them half way. The conduct of the company was influenced by a desire that their men should be contented and proud to continue their association with them. Sir Albert again expressed the pleasure it gave him to inspect the constabulary, and said that if ever the time should come when more serious work had to be done he was quite sure this act of preparedness would bring its good reward.

At the call of Mr. Rainforth, the men gave three hearty cheers to express their appreciation of Sir Albert Stanley's visit and interest.

DENNIS SALOON OMNIBUS.

The Gower Vanguard Motors, Limited, recently received delivery from Dennis Brothers, Limited, Onslow Works, Guildford, of the handsome saloon vehicle depicted in the appended illustration. It is used for the conveyance of munition workers in the Swansea district. There are many points in this design of body that are sure to appeal to users, for it provides a degree of comfort unobtainable in an ordinary omnibus or a chars-a-banc. The seating capacity is 28.

Saloon Omnibus for Government Workers.

Messrs. Dennis received the order before the outbreak of the war, the proprietors being very old users of Dennis vehicles, and prior to the war all their motor conveyances were machines of the same manufacture. Because of the national use to which the owners are putting the vehicle, the War Office recently gave permission to Dennis Brothers to execute the order.

Fortunate indeed are the munition workers to have so comfortable a conveyance placed at their service. The arrangement of the doors enables it to be rapidly filled and unloaded. All the doors are so arranged that access to the various seats is obtained from either side alternately. The windows are detachable excepting those to the doors, and these drop inside. Pigskin leather is used for the upholstering of the interior of the saloon, while the body is painted cream colour, with top sides to match the upholstery.

Omnibuses and Women Drivers.—There are rumours that a large omnibus company already recognises the possibility of having either to suspend necessary services or to employ women as drivers. Doubtless there will be great difficulty in finding women who are willing and capable of receiving instruction in the driving of the omnibuses in streets beset with dangers, but for months past women have driven numerous light commercial motors and horse vehicles in all parts of the kingdom.

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MOTOR TRAFFIC.

PETROL ECONOMY.

The Petrol Sub-Committee of the Commercial Motor Users' Association have recommended that the following points be brought to the notice of the members with a view to encourage further economies in the use of petrol :— (*a*) That a bonus shall be offered to drivers, based upon present average consumptions, to the extent of half the value of the petrol saved ; (*b*) that an accompanying instruction shall be issued to drivers to stop the engine when the vehicle is collecting or delivering, or when a halt (other than in traffic) may exceed one minute in duration.

The Committee of the Royal Automobile Club have recommended the discontinuance of the practice of using private cars as a daily means of transport from the country to places of business in towns, where railways or public service vehicles are available. The committee state that representations are being made to the local authorities to see that stocks of petrol are not laid in far in excess of those allowed by law, a practice that has led to shortage at a time when there was no real deficiency. Provided that the motoring public adopt their suggestion, the committee are assured that the wholesale and distributing companies are confident of being able to keep up the supplies necessary for legitimate use.

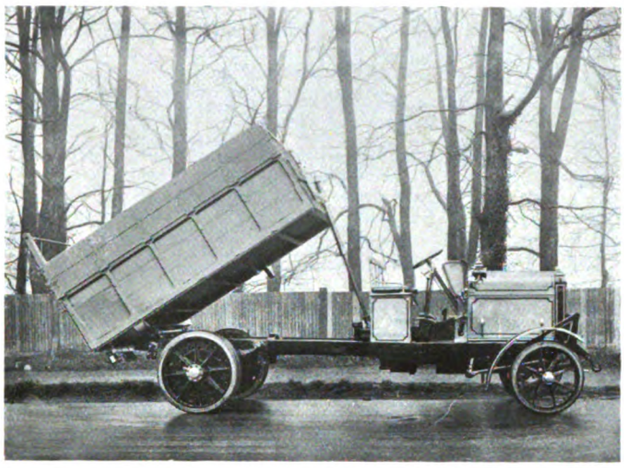
On March 22 the Royal Automobile Club issued a denial of the imputation made by the National Organising Committee for War Savings that there was an extensive use of motor vehicles for purely pleasure purposes. The great majority of owners were doing invaluable work by transporting the wounded and in other directions, entirely voluntarily. The statement concludes as follows : — "A very large saving of public money has been effected by the services of motor car owners in carrying wounded from the ambulance trains to the hospitals in every part of the country, and between the hospitals themselves, also by other gratuitous assistance freely given to the naval, military, and police authorities. Had this assistance been withheld a very large expenditure would have been necessary to establish and maintain these services even had it been found possible to obtain drivers. Motor car owners in volunteering their cars for these purposes are contributing towards the revenue by their payments in respect of motor car and petrol taxes."

ELECTRIC VEHICLE PROGRESS.

Less than three years have passed since a serious attempt was made to forward the sale of battery vehicles in this country, but from the March quarterly issue of the *Electric Vehicle*, the official organ of the Electric Vehicle Association, we learn that the total number of such machines now in use, or on order, is 678. Two years ago there were only 150. From a report issued by the Bureau of Census, Washington, we are able to compare British progress with that of the United States. The document shows that during the year 1914 the number of electric battery vehicles constructed was 4,715. This total is an increase of 22·9 per cent. on the output in 1909. Of course many of the cars in use in Great Britain are imported from the States, the war having in some respects interfered with the introduction of the electric vehicle, while assisting it in other directions. The British rate of increase is therefore exceedingly encouraging.

THORNYCROFTS FOR THE CITY OF LONDON.

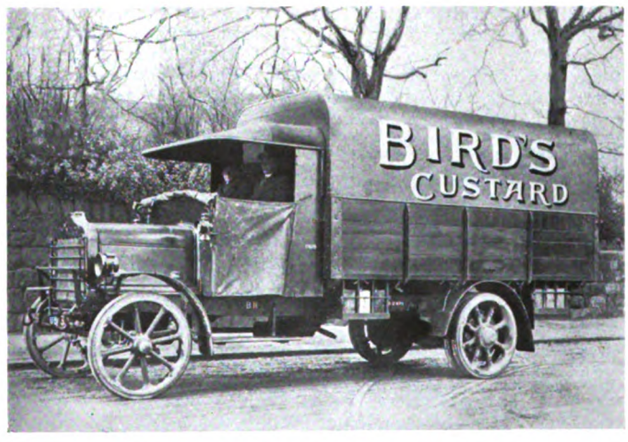
The Corporation of London have recently placed an order with Messrs. John I. Thornycroft and Company, Limited, for six 40-H.P. type "J" lorries, similar to those being supplied to H.M. War Department for foreign service. These vehicles, as will be seen by the accompanying illustration, have interchangeable bodies, viz., watering wagon and tipping wagon. The machines are replacing the fleet of Thornycroft steam wagons that have been in use by the Corporation for fourteen years or so, having during that period given extremely satisfactory service.



Successors of 14 Year Old Thornycrofts.

RECENT DAIMLER DELIVERIES.

Alfred Bird and Sons, Limited, custard powder manufacturers, of Birmingham and London, have overcome the temporary difficulty of obtaining delivery vans of an elaborate type by purchasing two wagons constructed to War Office specifications by the Daimler Company, Coventry. The firm was one of the first to utilise motor vehicles, and in peace time the bodies of all new additions are noted for attractive advertisement designs. They have found Daimler vehicles so reliable and economical in upkeep that two of War Office subsidy type are now being utilised for the heavy part of the work of their transport service. In these days of restricted railway services a number of manufacturers have found similar vehicles to be of the greatest utility.



Daimler War Vehicle for Civil Use.

Numerous passenger and goods chassis have recently been delivered to or ordered by Birmingham Corporation (six), to the Walsall Corporation (nine), Manchester Corporation (five), the Sheffield Corporation (four), Rotherham Corporation (three), Chesterfield Corporation (two), Lanarkshire Tramways (four), Mansfield and District Tramways (one), and East Surrey Traction Company (four).

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MOTOR TRAFFIC.

ELECTRIC VEHICLE COMMITTEE.

At a meeting of the Electric Vehicle Committee, held in London, Mr. A. C. Cramb, president of the Incorporated Municipal Electrical Association, presided in the enforced absence, through indisposition, of the chairman of the committee, Mr. R. A. Chattock.

A letter was read from Mr. A. J. Marshall, secretary of the Electric Vehicle Association of America, congratulating the committee upon their very tangible progress in the introduction of electric vehicles. Mr. Marshall expressed the belief that before long the importance of the splendid promotion would be very generally recognised, and would result in a tremendous increase in electric vehicle application.

STANDARDISATION OF LEAD-ACID CELLS.

The accumulator manufacturers' section of the British Electrical and Allied Manufacturers' Association, having been asked to consider the possibility of further standardisation of lead-acid accumulators for electric vehicles, particularly in regard to rating and the overall sizes of cells, had replied stating that they were prepared to agree to the standard sizes and rating as set forth below. This is considered satisfactory by the committee as meeting present requirements. These, as well as other matters in connection with lead-acid accumulators that have, with the co-operation and assistance of the manufacturers, been standardised, will be known as the E.V.C. standards, but it is hoped that the British Engineering Standards Committee may adopt them as British standards. Purchasers of electric vehicles, when lead-acid cells are intended to be used, are urged to insist that in rating and construction they should be in accordance with the E.V.C. standards, which are now as follow :—

"*E.V.C.*" *Standard Rating.*—This shall be the capacity in ampere-hours obtained by a continuous discharge at a uniform rate for a period of five hours until the voltage of the cell falls to 1·7. Example :—If a battery is specified to have an "E.V.C." standard rating of 180 ampere-hours, it means that the battery will give this capacity when discharged at a continuous rate of 36 amperes for a period of five hours, at the end of which time the voltage per cell shall not have fallen below 1·7 volts.

"*E.V.C.*" *Standard Plates.*—Height $8\frac{5}{8}$ in., width $5\frac{3}{4}$ in., lug centres $4\frac{3}{8}$ in.

"*E.V.C.*" *Standard Overall Sizes.*—For all sizes the width of the cell shall be $6\frac{5}{16}$ in., and the overall height, including connecter, $14\frac{7}{8}$ in. The length of the smallest size, i.e., that with 7 plates, shall be $2\frac{7}{16}$ in., with the addition of $\frac{5}{8}$ in. for each pair of plates above seven plates. An exception is in the case of the Chloride Accumulator Company's "Ironclad-Exide" type of cell, in connection with which the length of the 7-plate size is $2\frac{3}{4}$ in., with the addition of $\frac{3}{4}$ in. for each pair of plates above seven plates.

"*E.V.C.*" *Standard Inspection Plug.*—Shall be that which will fit a hole in the cover of the cell 1 in. in diameter.

"*E.V.C.*" *Standard Charging Voltage.*—Shall be that which is suitable for charging 44 lead-acid cells, i.e., 85 to 120 volts.

The overall sizes agreed upon by the members of the Accumulator Manufacturers' Section of the B.E.A.M.A. are the maximum sizes, the intention being that the dimensions will cover any maker's cells containing each the same number of plates. This has been done in order that vehicle makers may so construct the battery boxes on vehicles that cells of a specified number of plates of any make may be fitted.

SUPPORT FROM MUNICIPALITIES, ETC.

The secretary reported that since October subscriptions amounting to £56 14s. for carrying on the work had been received from municipalities, electric supply companies, manufacturers, and others.

The committee have again undertaken to award money prizes amounting in all to a sum of £10 at this year's inspection of motor vehicles, to be held under the auspices of the Commercial Motor Users' Association, the awards to be to drivers of electric vehicles who obtain the highest marks in written and oral examinations coupled with inspection of their vehicles under running conditions.

FACILITIES FOR RE-CHARGING.

Allusion was made to the difficulties of delay or exorbitant prices experienced, in a few districts bordering upon the London area, for boosting charges. The committee's standard tariff is 1d. per unit for "off-peak" charging, with a minimum of 2s. per charge (24 units at 1d.), and the committee appeal to all central station engineers to adopt this rate. They point out that by charging exorbitant prices the undertaking is hindering the extension of the use of electric vehicles. It is not necessary to put down any expensive motor-generator plant or switchgear ; all that is necessary is a permanent connection from the switchboard bus bars through a d.p. switch and fuses, or a maximum overload circuit-breaker, through an adjustable water resistance to a British standard charging plug. If there is a booster set or an exciter in the station, giving about 120 volts, which can be used for the purpose when required, so much the better. The operating staff must, of course, show an intelligent interest in the electric vehicle, and offer prompt and willing service whenever a car comes in for a charge.

TIRE AND RESEARCH COMMITTEE.

The committee has been invited by the Society of Motor Manufacturers and Traders to nominate a representative to sit upon the Tire and Research Committee recently appointed by the society to investigate all technical matters relating to rubber tires. The Electric Vehicle Committee has accepted this invitation with pleasure.

ALBION CHASSIS FOR MAIL VANS.

Mr. W. Donne Marshall, mail contractor, Dublin, is the owner of the two Royal Mail vans illustrated below. One has a chassis with a history, for it was delivered to its original owners as part of a pleasure car ten years ago. During the past twelve months each van has traversed over 22,000 miles, running 80 miles nightly on a double journey between Dublin and Kells.

Albions in Dublin Rural Mail Service.

The two vans were supplied by the Albion Motor Car Company, Limited, Glasgow, who frequently come across instances in which their vehicles have given a decade of service and yet are capable of standing the strain of the strenuous work in which these two Albions are nightly engaged.

MOTOR OMNIBUSES IN NEW YORK.

The "Bureau of Franchises" has presented to the Board of Estimates of New York City its preliminary report upon the amended application of the Fifth Avenue Coach Company for the right to operate motor omnibuses in the borough of Manhattan. In its summary of conclusions the Bureau says :—

"(1) That any franchise providing for compensation to the city, based on net profits, should also provide for city supervision of all operations in and about such enterprise.

"(2) Such provisions would require a technical staff to protect the city's interest, which would probably incur more expense than would be warranted by the return to the city.

"(3) A franchise providing for compensation to the city on the basis of gross receipts is generally more advantageous to the city than one based on net receipts.

"(4) The contract submitted by the Fifth Avenue Coach Company does not give the city sufficient supervision to insure the collection of any sum in excess of $75,000 yearly.

"If the board does not deem it advisable to depart from its heretofore fixed policy in this respect, then there is to be determined what action should be taken upon the proposal of the New York Motor 'Bus Company, Incorporated. If, however, the board feels that it should consider a franchise providing for compensation to the city on the basis of net receipts, then it would seem that the board should draft a contract that will, in so far as possible, protect the interests of the city, and then request proposals based on that form of contract."

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MOTOR TRAFFIC.

ERITH OMNIBUS SCHEME WITHDRAWN.

ARRANGEMENT WITH THE L.G.O. TO AVERT COMPETITION.

At a special meeting of the Erith Urban Council in Committee, consideration was given to the appended correspondence from the Ministry of Munitions relating to the recently instituted London General Omnibus Company's service to munition works in the district. It transpired that the omnibuses came to Erith in the first place by permission of one department of the Ministry, but when it was found that they competed with the Council's tramways, a conference of officials was held, and the terms mentioned below were settled. It will be seen that whilst the present service of omnibuses will end at St. Augustine's Church, Belvedere, a new route will be covered to serve Higher Belvedere, and another opened between Erith and Crayford.

WHITEHALL, S.W.,
March 10 1916.

The Clerk to the Urban District Council, Erith.

Dear Sir, I beg to refer to your letter of February 8, regarding the service of motor omnibuses which has been started by the London General Omnibus Company between Woolwich and Erith, along your Council's tramway route.

The Minister is anxious to prevent overlapping and waste of energy, and has considered the most effective method of co-ordinating your tramway service with the service of the London General Omnibus Company. He appreciates the public-spirited action taken in the past by your Council in connection with the tramway service at Erith, and is desirous that, with due regard to the paramount importance of providing the fullest possible facilities for the conveyance of munition workers, any settlement arrived at should give full consideration to the claims of the Urban District Council.

The following terms are now proposed as a settlement of the matter:—

1. The London General Omnibus Company shall restrict their service of omnibuses now running in competition with the Erith Council's tramways by terminating this service at St. Augustine's Church, it being understood:—
   (*a*) That the Council will assist as far as they can at the terminal point in providing the necessary turning and standing facilities;
   (*b*) That the London General Omnibus Company will so adjust their fares as to minimise all possibility of local competition with the tramways;
   (*c*) That in the event of the service still being found to be competitive with the Erith tramways, the Omnibus Company will reduce the present all-day service to a "rush hour" service only.
2. The London General Omnibus Company should provide an omnibus service (to the reasonable satisfaction of the Ministry of Munitions) between Woolwich and Erith, via Bostall Heath, West Heath, and Upper Belvedere, Friday Hill, and Fraser Road, which route is not at present provided with transit facilities.
3. The London General Omnibus Company should provide an omnibus service (to the reasonable satisfaction of the Ministry of Munitions) between Erith and Crayford, via North End, to meet the requirements of Messrs. Vickers' workers between Crayford and Erith.
4. The Erith Council should, if necessary, run a full service of tramcars during the "rush hours," employing for this purpose the maximum number of cars which they may have available.
5. The Erith Council should agree to withdraw their application for the Provisional Order, which, if issued, will enable them to run motor omnibuses.

I venture to express the hope that the terms here suggested will receive the approval of your Council, and shall be happy to hear from you after you have had an opportunity of submitting the matter to them.

Yours faithfully,
(*Signed*) R. L WEDGWOOD, Director, Munitions Railway Transport.

The terms set forth in the correspondence were agreed to by the Council, who were advised that any infringement of the conditions by the Omnibus Company would release the Council from their part of the obligation, and would enable them to proceed with their application for powers to run omnibuses. One result of the agreement is that the company's vehicles are diverted to a road entirely maintained by Kent County Council. The latter authority had decided to oppose the Urban Council's application unless they agreed to pay them ½d. per car mile. The London County Council had also demanded a contribution towards road maintenance, besides a financial adjustment as regards routes competing with their tramways. There is now to be unconditional operation of omnibuses over the roads of the two county authorities.

The agreement was adopted at an open meeting of the Council on March 27.

COMMERCIAL MOTOR USERS' ASSOCIATION.

Colonel R. E. Crompton, C.B., chairman, presided over the thirteenth annual general meeting of the Commercial Motor Users' Association on April 4. In presenting the annual report and accounts, he referred to the close touch the Association kept with the military and naval authorities, giving its assistance to these services on many occasions. The Association was successful in securing a rebate of 50 per cent. off the recent petrol tax for commercial motor users, and had established, with the co-operation of the War Office, a special employment bureau for discharged army motor drivers. As a result of the activities of the Association, motor lorry drivers had been placed on the list of "certified occupations," thus lessening the serious shortage of drivers. The Association investigated every matter affecting commercial motor users, and opposed any order prohibiting the use of heavy motor cars on the highway. He drew attention to the rapid increase in membership, which during the past five years had increased from under 300 to over 1,500 users, representing over 20,000 vehicles.

MOTOR VEHICLES FOR MUNICIPALITIES.

WEST BRIDFORD URBAN COUNCIL have completed negotiations for the purchase of a seventh motor omnibus.

MANCHESTER TRAMWAYS COMMITTEE have placed a contract with Daimler and Company, Limited, for four motor omnibus chassis.

LANCASTER TRAMWAYS COMMITTEE have decided to purchase four Edison battery chassis, which will be fitted with omnibus bodies by the Brush Company.

SHEFFIELD HEALTH COMMITTEE have placed an order with Edison Accumulators, Limited, for a third electric vehicle, at a cost of £1,000, for the collection of house refuse.

WALSALL COUNCIL on March 13 voted £3,886 from the tramways and motor omnibus profits during the year ended December 31 last, for the purchase of additional omnibuses.

SHEFFIELD HIGHWAYS COMMITTEE have been informed that the War Office have agreed to release the six lorry chassis that the committee have had on order since August, 1914.

GLASGOW CLEANSING SUB-COMMITTEE, after visiting three towns to inspect the work of electric wagons in collecting house refuse, have recommended the purchase of two 2-ton Edison wagons.

BURTON-ON-TRENT TRAMWAYS COMMITTEE have obtained a Provisional Order from the Local Government Board empowering them to provide motor omnibuses for use within the borough.

KENSINGTON COUNCIL recently ordered a coke fuel motor chassis, but the National Steam Car Company were unable to execute the order, owing to the large amount of work that they had in hand. The Council are therefore purchasing a 3½-ton Napier chassis.

READING COUNCIL have deferred until after the war the provision of railless trolley vehicles and omnibuses in connection with the Corporation Tramways. At the March meeting of the Council, Alderman Chivers proposed that one motor omnibus be purchased forthwith, but the motion was lost.

HALIFAX TRAMWAYS COMMITTEE, in order to meet the needs of the motor omnibus department, have recommended the Corporation to purchase two 3-ton Daimler chassis at £1,488. The purchase is also advised of a standard 2-ton Edison battery chassis, complete with electrical tip body, at £977, for the removal of ashes from the electricity works.

SHEFFIELD TRAMWAYS COMMITTEE have authorised the inauguration of a motor omnibus service between Firth Park tramway terminus and Ecclesfield. This step completes, we believe, the work of providing every main road out of the city with a means of public conveyance beyond the tramway terminus. The tramways department had for some time been engaged in arranging this system of feeders, and the work has been hastened in some localities in order to meet the needs of munition workers. Considerable additions remain to be made to the various services before the maximum amount of traffic is reached, but owing to the difficulty of obtaining vehicles (unless required for the conveyance of war workers), it will probably not be possible to take the task fully in hand until the war has ended. Including an additional chassis that has been ordered at a cost of £805, the tramways department are now working twenty-two omnibuses, but there is scope for at least forty-five such vehicles. The body for the new vehicle is being constructed in the tramway workshop, and the cost of the complete conveyance is to be charged to the motor omnibus reserve fund.

STEEL RESEARCH.

Good progress is being made by the Joint Committee on Steel Research, which is composed of representatives of the Admiralty, War Office, Royal Aircraft Factory, Aircraft Steel Makers Committee, Iron and Steel Institute, Institution of Automobile Engineers, and the Society of Motor Manufacturers and Traders, Limited. The investigation is being conducted to establish the physical properties of the standard automobile steels, and the factors governing testing procedure in connection therewith.

Offers of steel gratis have already been received from Cammell, Laird and Company, Limited, W. Beardmore and Company Limited, Brown, Bayley and Company, D. Doncaster and Company, W. T. Flather, Limited, T. Firth and Sons, Limited, Hadfields, Limited, Steel, Peech and Tozer, Limited, Sir J. Jonas, Colver and Company, Limited, Vickers, Limited. The majority of these offers have been provisionally accepted. Messrs. Kayser, Ellison and Company, Limited, have undertaken to do any rolling required.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

War Office Lorries for the Port of London.—The War Office have placed at the disposal of the Port of London Authority forty motor lorries for one month, to assist in the clearance of goods from the docks.

Petrol Restrictions in Germany.—A contributor to the *Retch* (Petrograd), who has made a journey through Germany, says that there are no taxis or motor cars either in Berlin or other big towns, as the Government have prohibited the use of petrol for running cars save on Government service.

The Need for Non-Skid Tires.—A motor omnibus belonging to Todmorden Corporation on March 18 skidded and crashed into a wall after striking several persons who were walking along the road. A woman died shortly afterwards from the effects of her injuries, while two other individuals were badly hurt. It is stated that some months ago the Corporation Omnibus Committee dispensed with third-party insurance.

Haulage of Road Materials.—Devonshire County Council, on March 21, agreed to purchase one mile of portable tramway track and three wagons at £238, and 700 yards of tramway track at £100 in order to enable the surveyor to obtain the stone necessary for the maintenance and repair of the main roads in the northern division. The surveyor stated that a large saving would be effected both by avoiding cost of cartage and damage to road surface.

Southend Omnibus Service.—Owing to local conditions, Southend-on-Sea Corporation have abandoned their motor omnibus services for the present. It is possible, however, that after the war a new service will be inaugurated. Loughborough Motor Omnibus Company, who are already operating five electric omnibuses, have offered to purchase the Edison omnibus belonging to Southend Corporation Tramways Department for the sum of £1,100. The Tramways Committee have adjourned the consideration of the offer for six months.

Petrol Economy for Commercial Users.—Petrol saving is a more important item with commercial vehicles, in view if their heavy consumption, than with pleasure cars. The Zenith carburetter proves just as effective for trade vehicles as in other directions. For instance, Mr. T. Gardner, of 28, Princess Road, Levenshulme, has informed the makers that he is getting a steady average of ten miles to the gallon with a Zenith carburetter on his Ryknield lorry, and the lorry "pulls well and came up rather a stiff hill here the other day with 4 tons 15 cwts. easily on second gear."

Conductor's Claim for Air Raid Injury.—In a Metropolitan County Court a conductor in the employ of the London General Omnibus Company applied for an award, under the Workmen's Compensation Act, in respect to injuries received in the airship raid on September 8. One of three airships dropped a bomb in front of an omnibus, killing the driver and eight passengers, and injuring the conductor. In refusing the application, the judge said he did not think that the nature of the man's duties prevented him from taking cover and performing his contract of service. He held that the applicant was exposed to no more risk than any of the passengers. He thought that the case was not so strong as that of Cooper v. North Eastern Railway Company, which was one where an engine-driver had taken shelter.

Commercial Cars Employees.—Commercial Cars, Limited, and their employees are to be congratulated on having promoted a highly successful concert, followed by a dance, at the Winter Assembly Hall, Luton, on March 18. The proceeds are to provide comforts in the shape of armchairs, card tables, etc., for the wounded soldiers at the military hospital at Wardown Park, Luton. A packed audience, amongst whom was a large number of officers and men, spent a highly enjoyable evening. The expectations of the "Commer Car" management were more than realised. There was no lack of talent to sustain the programme. The band of the 2/1st Northants Yeomanry gave a perfect rendition of Suppe's "Poet and Peasant," and played with great success for the dancing. Mr. G. R. Pauling discharged the duties of hon. secretary.

AMBULANCES AT BUCKINGHAM PALACE.

The ambulance column attached to the London district was inspected on March 23 by H.M. the King at Buckingham Palace, when the long convoy illustrated below presented an imposing appearance. The Napier ambulance shown in the foreground of the photograph was specially commented on by His Majesty on account of its smart and workmanlike appearance. This ambulance was presented to the Government by the Association of Master Lightermen and Barge Owners of the Port of London, and is mounted on a 16-22 h.p. Napier chassis. This model is doing splendid service at the front, where it is giving every satisfaction to the authorities in various theatres of the war.

Ambulance Column of the London District—A 16-22 h.p. Napier in the Foreground.

MOTOR COMPANIES DIVIDENDS.

Birmingham Small Arms Company.—Interim dividend on the ordinary shares at the rate of 5 per cent. per annum.

A. Darracq and Company, Limited, announce an interim dividend at the rate of 7 per cent. per annum on the preferred ordinary shares for the half-year ending March 31.

The Studebaker Corporation reports for the year to December 31 net sales amounting to $56,539,006 (increase, $13,094,783); net earnings, $9,095,432 (increase, $3,884,002); amount available for dividends, $9,067,425 (increase, $4,625,459); and a balance after payment of dividends of $6,840,400 (increase, $3,267,484). War orders for cars brought in $13,000,000.

The profit of Arrol-Johnston for 1915, including £8,078 brought forward and after providing for depreciation, debenture stock interest, excess profits tax, etc., amounts to £24,484. The directors recommend a final dividend of 10 per cent., free of tax, on the ordinary, leaving £20,484 to be carried forward. A year ago the dividend, including bonus, was 40 per cent., free of tax.

The profits of Leyland Motors, Limited, Preston, for the past year were £252,107, against £85,037 in the previous year. A final dividend of 2s. per share, free of tax, is proposed, making 15 per cent. for the twelve months, against 10 per cent. for 1914, writing off goodwill account £63,000, appropriating £50,000 for special depreciation, and £100,000 for a special reserve, and carrying forward £26,959, against £28,252 brought in to the account.

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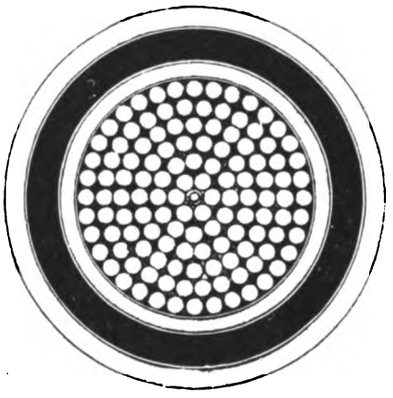
CABLES



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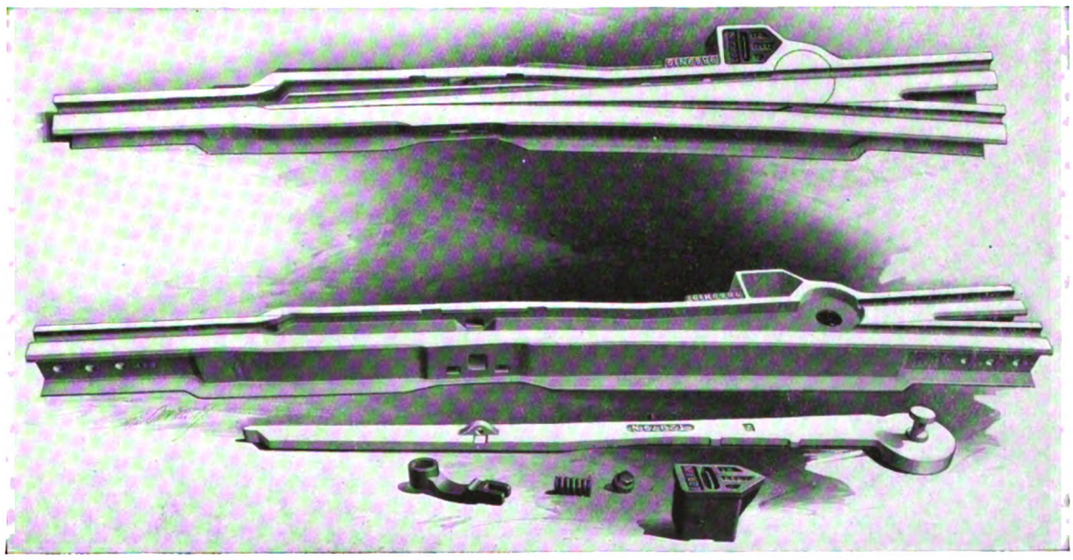

SOLID MANGANESE TADPOLE TONGUE SWITCH
Made with either grooved or plain Tongue

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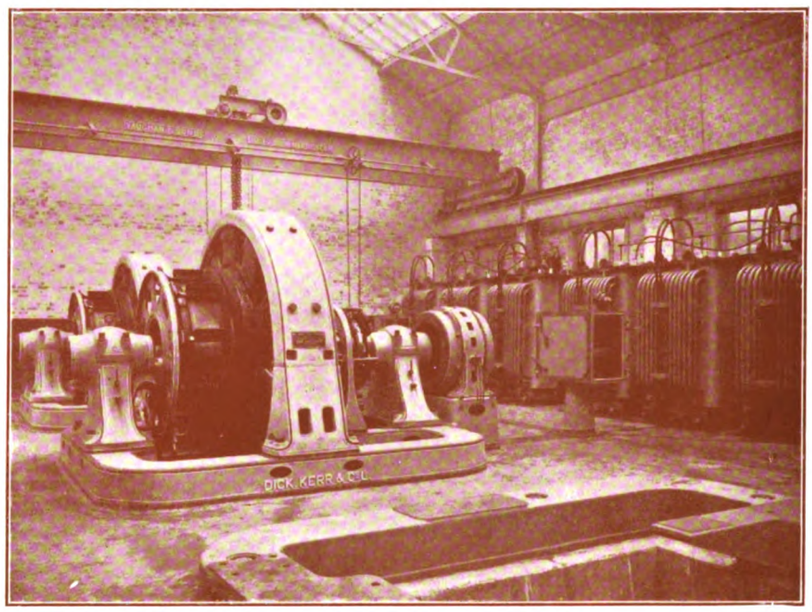
Rotary Converters

in Sub-station of Lancashire & Yorkshire Railway



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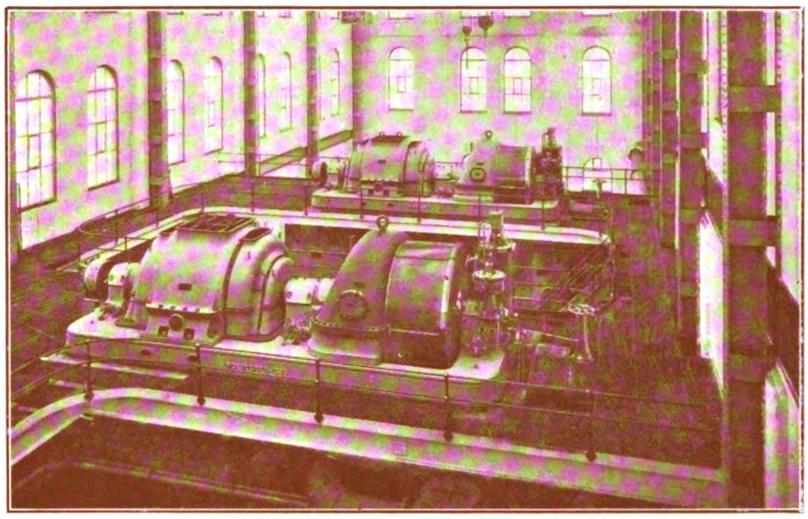
Turbo-Alternator Sets

in Power Station of Lancashire & Yorkshire Railway



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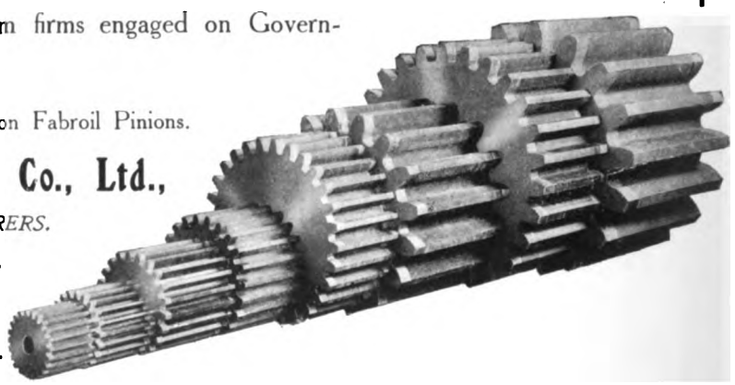

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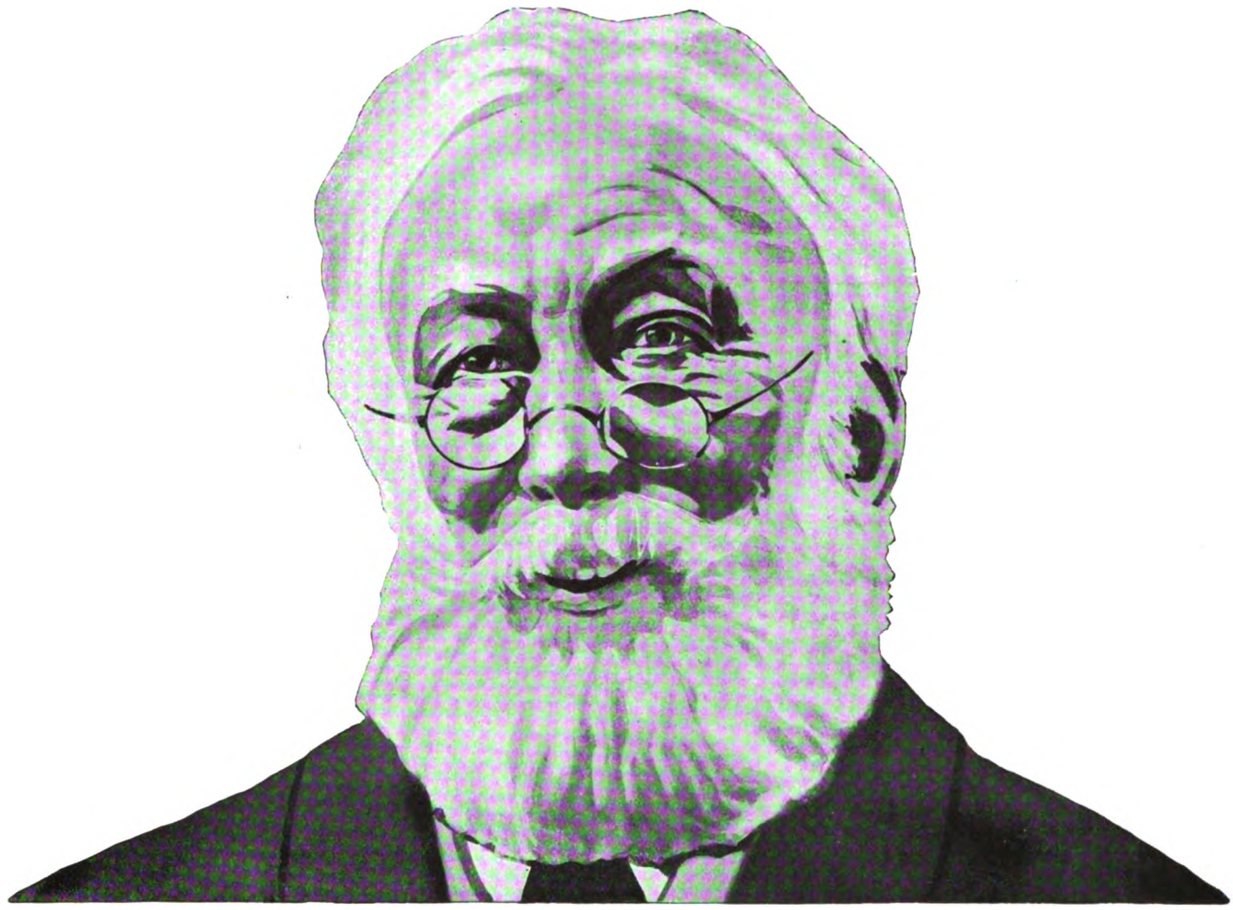

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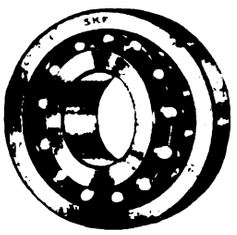

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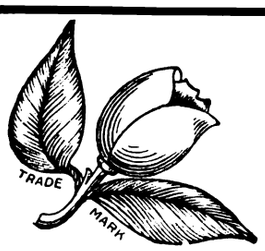

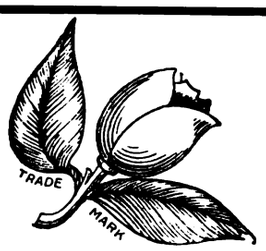

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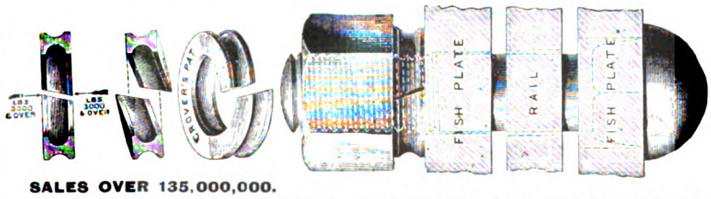

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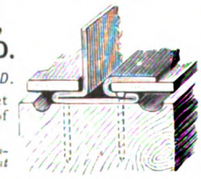

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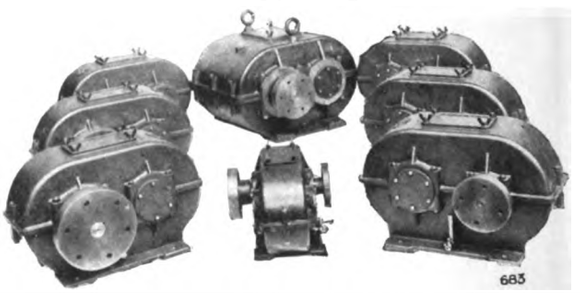

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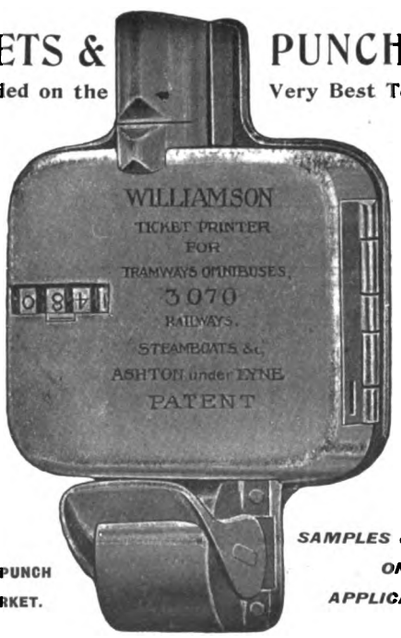

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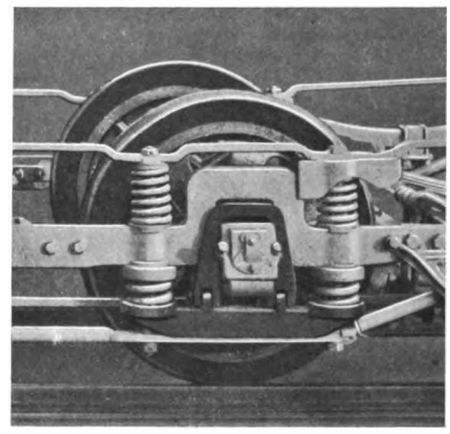

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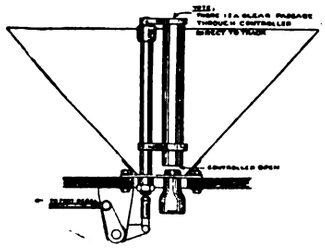

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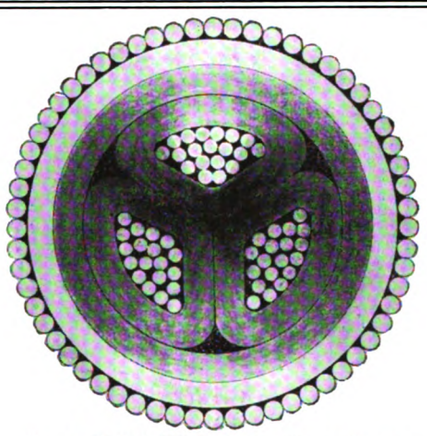

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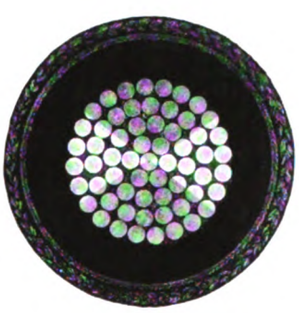

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All Communications and Advertisements for the Saturday's issue of "The Tramway and Railway World" should be received not later than 10 a.m. on Friday.

Advertisements of which proof is desired should reach us by the second post on Tuesday.

The Editorial and Publishing Offices of "The Tramway and Railway World" are at Amberley House, Norfolk Street, London, W.C.

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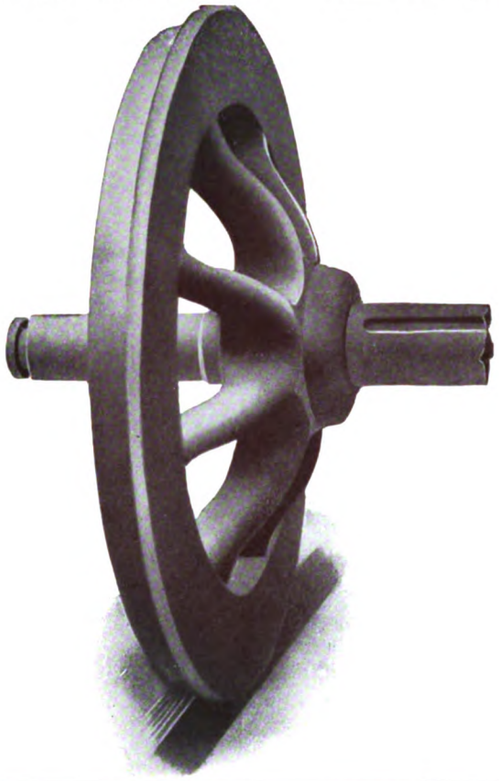

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IN THE UNITED KINGDOM.

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POSTAL ADDRESS, TELEGRAPHIC ADDRESS, AND TELEPHONE NUMBERS.

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Aberdare Urban District Tramways, Gadlys Estate, Aberdare. [T.A., Tramways, Aberdare: T.N., 17.] *Gen. Manager and Elec. Engineer*, A. J. Abraham; *Traffic Supt.*, H. King; *Chairman Try. Com.*, Coun. E. Stonelake.

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[Leased. See Dartford Tramways in list of Tramway Companies.]

Darwen Corporation Tramways, Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, F. J. S. Hosken; *Boro. Elec. Eng.*, C. H. Garnett; *Chairman Try. Com.*, Ald. Jas. Tomlinson.

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[Lines worked by Salford Corporation.]

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[Lines leased to the South Lancashire Tramways Co.]

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Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts; *Vice-Chairman*, Coun. C. J. Ramstedt.

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Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 86 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A. Fawcett.

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Heywood Corporation Tramways, Heywood, Lancs. [T.N., 47.] *Gen. Manager*, R. B. Leach; *Per. Wa Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Coun. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

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Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. J. A. Hennah.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Stanley Clegg, Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White; *Vice-Chairman*, Coun. M. A. Ashley.

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, C. W. Mallins; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *City Electrical Engineer*, Harold Dickinson; *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Coun. E. Russell Taylor; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 62, Finsbury Pavement, London, E.C. [T.A., Lotram Ave., London; T.N., 3321, 3322, and 3323 London Wall.] *Chief Officer*, A. L. C. Fell; *Deputy Chief Officer*, J. K. Bruce; *Traffic Assist.*, L. Slattery; *Rolling Stock Supt.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, G. H. Hume; *Vice-Chairman*, T. Prestige.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett.

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Coun. D. T. J. Lyle; *Vice-Chairman*, Coun. Green.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Coun. F. Goodyear.

Middleton Corporation Tramways. *Consulting Engs.*, Lacey, Sillar, and Leigh; *Chairman Try. Com.*, Ald. W. Wood, J.P. (Mayor); *Vice-Chairman*, Ald. Bentley, J.P.
[Worked by Manchester Corporation Tramways.]

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. R. Mayne; *Vice-Chairman*, Coun. A. M. Sutherland.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 990 L., Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Per. Way Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways, St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis; *Vice-Chairman*, Coun. W. Beale.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain, J.P.; *Vice-Chairman*, Ald. F. R. Radford, J.P.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, P. Priestley; *Traffic Supt.*, J. Brierley; *Chairman Try. Com.*, Ald. F. G. Isherwood; *Vice-Chairman*, Coun. F. Elliot.

Perth Corporation Tramways, 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Calderwood.

Plymouth Corporation Tramways, 15, Ebrington Street, Plymouth. [T.N. 518, Plymouth.] *General Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. S. H. Phillips, J.P.; *Vice-Chairman*, Coun. J. Moon.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Inspector*, W. May; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 110 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson; *Vice-Chairman*, Ald. R. Payne.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Traffic Supt.*, C. H. Manning; *Chairman, Try. Com.*, Ald. J. Ormrod; *Vice-Chairman*, Coun. T. Parkinson.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Walker Allen, J.P.
[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81 and 85.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. J. W. Stansfield.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P. (Deputy Mayor).

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, S. S. Platt; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. Taylor.

Rotherham Corporation Tramways, Rawmarsh Road, Rotherham. [T.A., Cross, Rotherham; T.N., 138, 152, and 241.] *General Manager & Elec. Eng.*, E. Cross; *Deputy Elec. Eng.*, J. R. Lilleker; *Traffic Superintendent*, H. Jagger; *Per. Way Eng.*, T. P. Collinge; *Rolling Stock Supt.*, C. A. Walker; *Chairman Try. Com.*, Ald. D. L. Winter; *Vice-Chairman*, Coun. T. Reeves.

St. Helens Corporation Tramways, Town Hall, St. Helens, Lancs. *Chairman Try. Com.*, Ald. Sir J. Beecham; *Vice-Chairman*, Coun. W. N. Pilkington.
[Lines worked by the New St. Helens and District Tramways Co.]

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, J. A. Robertson; *Traffic Supt.*, J. W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. W. H. Barrett.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Traffic Supt.*, A. Handford; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. Com.*, Ald. Sir W. Clegg, J.P.; *Vice-Chairman*, Coun. A. T. Bescoby, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, Wm Redman; *Chairman Try. Com.*, H. Pitts.
[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, W. T. Robson; *Boro. Elec. Engineer*, H. F. Street; *Traffic Manager*, C. G. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. Daniells; *Per. Way Eng.*, E. J. Elford (*Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Ald. A. Martin.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Piermaster*, Capt. N. E. Hucker; *Chairman*, Coun. H. Dowsett.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Ald. Griffiths, J.P.; *Vice-Chairman*, Coun. Clayton.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, H. S. Ellis; *Chairman Try. Com.*, Ald. W. G. Wylie; *Vice-Chairman*, Ald. J. W. Henderson.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Coun. S. C. Homer.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Ald. Chas. Sharples; *Vice-Chairman*, Ald. W. E. Hampett.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Chairman Try. Com.*, Coun. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker, J.P.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *Manager*, T. Medcalf; *Elec. Eng.*, A. Dimmack; *Consulting Engs.*, Lacey, Sillar, & Leigh; *Chairman Try. Com.*, Coun. A. D. Richards; *Vice-Chairman*, Coun. A. Bull.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1431, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H. Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

Walsall Corporation Tramway, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. Clarke; *Vice-Chairman*, Coun. R. J. Bishop.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Coun. Dr. G. W. Joseph; *Vice-Chairman*, Coun. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Try. Com.*, Ald. A. G. Turley, J.P. (Mayor); *Vice-Chairman*, Coun. G. Garratt.
[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 868 East.] *General Manager*, J. S. D. Moffet; *Boro' Elec. Eng.*, J. W. Beauchamp; *Chairman Try. Com.*, ———.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Charlton.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *Gen. Manager*, F. Buckley; *Per. Way Eng.*, A. T. Gooseman; *Chairman Try. Com.*, Ald. R. T. Fletcher; *Vice-Chairman*, Coun. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. W. H. Sessions.

COMPANY TRAMWAYS.

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, W. Jackson, Dr. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles, G. J. Somerville.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *Acting Manager*, W. E. Nicoll; *Acting Sec.*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Barrow; T.N., 125.] *Manager*, W. F. Bladon; *Sec.*, F. J. Cursons; *Acting Sec.*, J. S. Bowker; *Chairman*, H. S. Day; *Directors*, J. V. Kitchener, E. R. Soames.

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, Hon. Sir J. Sivewright, K.C.M.G.; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton, E. Callaird.

Bessbrook and Newry Tramway Company, Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, Robert Caven; *Elec. Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, T. McGreggor Greer.

Birmingham District Power and Traction Company, Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone, R. J. Howley.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Blackpool and Fleetwood Tramroad Company, Ltd., Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 121.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, John Greenwood; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington, G. Richardson, G. Readman.

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Blackpool, St. Anne's, and Lytham Tramways Company, Ltd., Squires Gate, and 30, Birley Street, Blackpool. [T.N., 327 and 22]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, G. Nicholson; *Directors*, T. M. Smith, T. Preston.

Bray and Enniskerry Railway Company, 62, Westland Row, Dublin. *Sec.*, M. F. Keogh; *Chairman*, A. Killingley; *Director*, F. M'Crea.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, Magnus Volk; *Traffic Superintendent*, H. Sheppard; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Chas. Challenger; *Assist. Manager*, S. E. Smith; *Electrical Engineer*, W. H. Munton; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, Sir G. White, Bart.; *Directors*, W. G. Verdon Smith (*Managing*), S. White, J.P., J. H. Howell, J.P., G. Stanley White.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. E. Garcke (*chairman*); *Directors*, C. Shirreff B. Hilton, W. L. Madgen, A. Shepherd, G. T. Symons, C. G. Tegetmeier, P. D. Tuckett; *Joint Managers*, C. H. Dade and R. J. Howley; *Acting Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.
Barnsley & District.
Barrow-in-Furness.
Birmingham & District Power & Traction Co.:
Birmingham & Midland
Dudley, Stourbridge, & District.
South Staffordshire.
Wolverhampton Dist.
Devonport & District.
Gateshead & District.
General Elec. Tramways.
Gravesend & Northfleet.
Greenock & Port Glasgow.
Jarrow & District.
Kidderminster & District.
Merthyr.
Middleton.
Oldham, Ashton, & Hyde.
Peterborough.
Potteries.
Rothesay.
Sheerness & District.
South Metropolitan.
Southport.
Swansea.
Taunton.
Tynemouth & District.
Weston-super-Mare & District.
Worcester.
Wrexham & District.
Yorkshire (Woollen Dist.)

Burton and Ashby Light Railways, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, A. L. Charles; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Douglas Owen.

Carlisle Tramways Company, Ltd., City of, Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, R. L. McCulloch.

Chatham and District Light Railways Company, Luton Road, Chatham, and 88, Cannon Street, London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Traffic Manager*, W. G. Davies; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Directors*, A. H. Beatty (*Chairman*), W. Shearer, H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C. A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, St. George's Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, Capt. W. Martindale, H. C. Levis.

Dartford Urban District Council Light Railways. Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Balfour, Beatty, & Co., Ltd., 66, Queen Street, London, E.C.) *Acting Manager*, F. A. Kincaid Fergusson.

Devonport and District Tramways Company, Electrical Federation Offices, London, W.C. [T.A., Head Office, Devonport c/o Tramway, London; T.N., Head Office, Holborn 2686. *Manager and Eng.*, George Cardwell; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier, R. J. Sutcliffe.

[The Company's undertaking has been sold to Plymouth Corporation.]

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways, (Lessees: The National Elec. Construction Co., Ltd., 3, Laurence Pountney Hill, London, E.C.) [T.A., Overhauled, London; T.N., 5329 and 5330 Bank.] *Manager*, W. MacGibbon.

Douglas—Ramsey. (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282 and 4066 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, A. B. Coyle, J.P., G. N. Murphy.

Dublin United Tramways Company (1896) Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. Marshall Harriss; *Elec. Eng.*, R. Tanham; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, W. M. Murphy, J.P.; *Directors*, W. F. Cotton, J.P., J. Mooney, Rt. Hon. L. A. Waldron, P.C.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley.

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 23, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, J. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager & Engineer*, Daniel Fisher; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A., Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Secretary*, H. W. Davis; *Chairman*, H. S. Day; *Directors*, H. A. Stagg, C. R. Greene, Judge L. A. Atherley-Jones, K.C.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, F. J. S. Moore; *Directors*, C. M'D. Stuart, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, A. W. Bullough; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 958, Gravesend.] *Manager*, J. R. Groves; *Sec.*, H. C. Walter; *Chairman*, W. L. Madgen; *Directors*, P. N. Gray, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A. Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, E. Valied, J. B. Collings, Q. Le Pelley.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. Vincent Edwards; *Secretary*, W. R. Elston; *Cons. Engs.*, Kincaid, Waller, Manville, and Dawsen; *Chairman*, G. Kitchen; *Directors*, E. C. Morgan, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, W. G. Verdon Smith; *Manager*, F. Freshwater; *Chairman*, Sir George White, Bart.; *Directors*, H. C. Godfray, J. H. Howell, S. White.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, ——————; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, W. M. Murphy, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *General Manager*, W. G. Bond, *Secretary*, B. Kingsford; *Chairman*, E. Garcke; *Directors*, J. A. Lycett, H. S. Day, W. L. Madgen.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 88, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager and Engineer*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. A. Stanley, M.P.; *Directors*, J. M. Henderson, M.P., Sir J. Beecham, J.P., R. Watson, J.P., A. Adam, J. S. Austen.

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, W. H. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey J. U. Hodgson, M. H. Maxwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

Llanelly and District Electric Lighting and Traction Company, Ltd., Llanelly, and 66, Queen Street, London, E.C. *Engineer and Manager*, J. E. Stewart; *Secretary*, G. D. Prince; *Chairman*, A. R. Holland; *Directors*, A. V. Anderson, M. A. Edwards, A. H. Beatty.

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *Gen. Manager and Eng.*, A. H. Pott; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, Sir A. H. Stanley, F. V. Schuster.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, A. E. Wray.

Mansfield & District Light Railway Co., Sutton Road, Mansfield. [T.A., Cars, Mansfield, T.N., 107.] *Gen. Manager and Sec.*, Stanley Dudman, *Chairman*, A. R. Holland; *Directors*, W. J. Chadburn, A. H. Beatty, G. Balfour.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, C. A. Huni; *Chairman*, Col. Sir A. Griffith Boscawen; *Directors*, Sir W. H. Vaudrey, B. E. Greenwell, E. Remnant.

Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Secretary*, S. J. Clements; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

Metropolitan Electric Tramways, Limited, Electric Railway House, Broadway, Westminster, London, S.W. [T.A., Metrolito, London; T.N., 6800, Victoria.] Manor House Offices, Seven Sisters Road, N. [T.A., Lentiscus, London; T.N., 77 Tottenham.] *Gen. Manager and Eng.*, A. H. Pott; *Traffic Manager*, W. E. Hammond; *Secretary*, A. L. Barber; *Chairman*, E. Garcke; *Directors*, Sir E. Spencer, W. L. Madgen, C. G. Tegetmeier, J. Devonshire (*Managing Director*).

Mexborough and Swinton Tramways Company, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 3, Laurence Pountney Hill, Cannon Street, London, E.C. *Manager and Eng.*, ——— ; *Cons. Elec. Eng.*, F. E. Stanley; *Commercial Manager*, Wm. T. Mitchell; *Traffic Supt.*, M. McLeod; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Director* (*Managing*), W. B. Cownie, C.A.

Middlesbro, Stockton, and Thornaby Electric Tramway, Bridge Road, Stockton-on-Tees, and Clare Street House, Bristol. [T.A., Tramways, Stockton; T.N., 129.] *Manager*, F. Freshwater; *Secretary*, W. G. Verdon Smith; *Chairman*, Sir Geo. White, Bart.; *Directors*, H. C. Godfray, S. White, H. C. Doggett.

Middleton Electric Traction Company, Ltd., Hiltonfold Lane, Middleton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depot, Middleton; T.N., 37 Middleton.] *Gen. Manager*, W. F. Endean; *Secretary*, G. R. Oliphant; *Acting Secretary*, J. S. Bowker; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreathall.

Morecambe Tramways Company, Heysham Road, Morecambe, and 62, Market Street, Lancaster. [T.N. 1, Morecambe, and 71, Lancaster.] *Secretary and Manager*, G. H. Petty; *Chairman*, W. H. Pickles; *Directors*, J. Stott, S. Wright, O. Carr.

Musselburgh and District Electric Light and Traction Co., Ltd., High St., Musselburgh, N.B. [T.A., Tramways, Musselburgh; T.N., 115.] (Registered Office, 3, Laurence Pountney Hill, London, E.C. [T.N., 5329 and 5330, Bank.]) *Manager*, R. Watson; *Resident Engineer*, E. J. Walsh; *Traffic Inspector*, W. Mittell; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, B. Burnham, J. Anderson, W. B. Cownie, R. Watson.

New General Traction Company, Ltd., 8, Crosby Square, London, E.C. *Managing Director*, E. A. Hopkins; *Secretary*, J. G. Mills; *Chief Engineer*, I. E. Winslow; *Chairman*, Baron E. B. d'Erlanger. [This company controls the Norwich and the Douglas Southern Electric Tramways Companies.]

New St. Helens and District Tramways Company, Ltd., Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36 Atherton.] *Engineer and Manager*, C. D. Stanley; *Secretary*, H. P. Conibear; *Chairman*, Hon. Arthur Stanley, M.P.; *Directors*, J. Hunter, J.P., H. Martin, J.P., J. M. Henderson, M.P., J. S. Austen, and E. H. Edwardes (*Managing*).

North Shields Tramway Company owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

Norwich Electric Tramway Company, 5, Orford Hill, Norwich, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, F. W. Ketley; *Consulting Eng.*, I. E. Winslow; *Sec.*, J. G. Mills; *Directors*, E. A. Hopkins, Hon. A. G. Brand, F. FitzGerald, G. M. Chamberlin, and C. Pakeman.

Nottinghamshire and Derbyshire Tramways Company, Tramway Depot, Langley Mill, Derbyshire, and 66, Queen Street, London, E.C. [T.A., Tramways, Langley Mill; T.N., 53, Langley Mill.] *Manager*, C. R. Walker; *Secretary*, Wm. C. Bryden; *Directors*, A. R. Holland, A. H. Beatty, A. V. Anderson, and M. A. Edwards.

Oldham, Ashton and Hyde Electric Tramway, Ltd., Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Denton; T.N., 265 Ashton.] *Supt.*, A. Anderson; *Secretary*, F. J. Cursons; *Acting Secretary*, J. S. Bowker; *Chairman*, E. Garcke; *Directors*, Judge L. A. Atherley Jones, K.C., W. S. Wreathall, J. V. Kitchener (*Managing Director.*)

Paisley District Tramways Company, Tramway Depôt, Paisley, and 83, Cannon Street, London, E.C. [T.N., 218 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Lord Arthur Butler, D. Johnston Smith, John Young.

Peterborough Electric Traction Company, Ltd., Lincoln Road, Peterborough, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Peterborough; T.N., 224.] *Gen. Manager*, T. G. Clabburn; *Secretary*, S. M. Wright; *Actiug Sec.*, P. N. Gray; *Chairman*, Lord Vaux of Harrowden; *Directors*, E. A. Paris, R. J. Howley.

Plymouth, Stonehouse and Devonport Tramways Co., 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. [T.N. 53.] *Manager*, G. H. Moreton; *Elec. Eng.*, J. Graham Pearce; *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*).

Portsdown and Horndean Light Railway, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Engineer and Manager*, J. Fereday Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern.

Potteries Electric Traction Company, Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Stoke-on-Trent; T.N., 141.] *Gen. Manager and Eng.*, W. Thom; *Power and Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, B. Kingsford; *Chairman*, R. J. Howley; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

Rhondda Tramways Company, Ltd., Tramway Depot, Porth, Rhondda, and Laurence Pountney Hill, Cannon Street, London, E.C. [T.A., Tramways, Porth; T.N., 118.] *Manager and Engineer*, H. Holliday; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, H. T. Barnett.

Rothesay Tramways Company, Ltd., Point House, Rothesay, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, A. C. Miles; *Directors*, W. L. Madgen, H. S. Day.

Ryde Pier Company, Ryde, Isle of Wight. *Manager*, W. D. Stanney; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

Scarborough Tramways Company, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, J. V. Moinet; *Chairman*, F. E. Gripper; *Directors*, V. Fowler, M. T. Whittaker, J. C. Wigham.

Sheerness and District Electric Power and Traction Company, Ltd., Electricity Works, Sheerness East, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Sheerness; T.N.,45.] *Manager & Eng.*, A. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, R. J. Howley, E. R. Soames.

Snaefell Mountain Railway (See Manx Electric Railway Company).

South Metropolitan Electric Tramways and Lighting Company, Ltd., 114, Church Street, Croydon, 30, High Street, Sutton, and Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 304 Croydon, 14 Sutton and 6800, Victoria.] *Gen. Manager and Engineer*, A. V. Mason; *Secretary*, W. M. Wright; *Chairman*, C. G. Tegetmeier; *Directors*, J. Devonshire (*managing*), E. Garcke, A. L. Barber.

Southport Pier Co., Ltd., Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, A. T. Faiers; *Chairman*, A. Skinner; *Directors*, J. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

Southport Tramways Company, Ltd., The Depôt, Churchtown, Southport, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, J. Lloyd; *Secretary*, H. A. Stagg; *Chairman*, C. S. Hilton; *Directors*, J. S. Raworth, Lord Vaux of Harrowden, J. V. Kitchener, G. R. Hulme.

South Staffordshire Tramways (Lessee) Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, W. S. Schuster; *Directors*, J. A. Lycett, S. R. Blundstone, R. J. Howley, B. Kingsford.

Sunderland District Electric Tramways. Ltd., Fence Houses, co. Durham. [T.A., Trams, Philadelphia, Shiney Row; T.N., 21, Houghton-le-Spring.] *Resident Manager and Engineer*, G. Stratton; *Traffic Manager*, E. A. Pearman; *Secretary*, H. J. Almond; *Directors*, H. R. Hogg, Hon. R. Parker, R. Tayler, A. Counter, C. Eves.

Sutton and Howth Electric Tramway Company (owned by the Great Northern Railway, Ireland), Sutton, county Dublin, and Amiens Street Station, Dublin. [T.A., Railroad, Dublin; T.N., 171, Dublin, and 16 Sutton.] *Gen. Manager*, John Bagwell; *Elec. Eng.*, A. W. Whieldon; *Chief Eng.* F. A. Campion; *Locomotive Eng.*, G. T. Glover; *Sec.*, T. Morrison; *Chairman*, F. Vernon; *Directors*, W. P. Cairnes (*Deputy Chairman*), W. B. Carson, H. S. Guinness, J. T. Reade, Capt. W. L. A. Goulding, Lt.-Col. J. C. W. Madden, R. A. Gradwell, J. Milne Barbour, T. F. Cooke, W. H. B. Moorhead, Lt.-Col. H. Plews, G. S. Clark.

Swansea Improvements and Tramways Company, 2, Rutland St., Swansea, and Electrical Federation Offices. Kingsway, London, W.C. [T.A., Tramway, Swansea; T.N., 268 Swansea.] *Gen. Manager*, D. James; *Elec. Eng.*, A. Johnston; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, G. J. Somerville, S. E. Garcke, E. R. Soames.

Taunton Electric Traction Company, Ltd., East Reach, Taunton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Taunton, c/o "Tramways," London.] *Manager*, B. H. Griffith; *Acting Manager*, L. Marshall; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, G. J. Somerville; *Directors*, E. Garcke.

Torquay Tramways Co., Ltd., St. Marychurch Road, Torquay. [T.A., Carsheds, Torquay; T.N., 167 Torquay.] *Registered Office*, 3, Laurence Pountney Hill, Cannon Street, E.C. *Manager and Eng.*, H. J. Nisbett; *Secretary*, L. D. H. Jacobs; *Managing Director*, W. B. Cownie.

Trafford Park Company (Tramways), Trafford Park, Manchester. [T.A., Developing, Manchester; T.N., 61, Trafford Park.] *Secretary*, C. A. Grundy; *Chairman*, Marshall Stevens; *Directors*, Sir J. Lyons, H. McNiel.

[Lines worked by the Manchester and Salford Corporations.]

Tynemouth and District Electric Traction Company, Limited, John Street, Cullercoats, Northumberland, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tram Co., Cullercoats; T.N., 17 Whitley.] *Gen. Manager*, H. J. Smith; *Sec.*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. H. Robinson, J. B. Williamson, R. J. Howley, Geo. J. Somerville.

Tyneside Tramways and Tramroad Company, Ltd., Neptune Bank, Wallsend. [T.A., Tramways, Wallsend; T.N., 84.] *Secretary & Res. Manager*, J. C. Little; *Elec. Eng.*, F. H. Briggs; *Cons. Eng.*, W. McLellan; *Chairman*, J. T. Merz; *Directors*, Lord Armstrong, J. H. Armstrong, G. E. Henderson, S. Hunter.

Wakefield and District Light Railway Company, Belle Isle, Wakefield.

[This company has been amalgamated with the Yorkshire (West Riding) Electric Tramways Co., Ltd.]

Walton-on-the-Naze Pier Tramway (Coast Development Corporation, Ltd.), The Pier, Walton-on-the-Naze. [T.A., Electricity Works, Walton-on-Naze.] *Eng.*, E. A. Lambert, A.M.I.E.E.

Wemyss and District Tramways Company, Ltd., Car Depot. Aberhill, Methill, N.B. [T.A., Tramways, Methill; T.N., 88 Leven.] *Gen. Manager*, W. T. Dawson; *Sec.*, J. O. Shepherd; *Chairman*, G. Balfour; *Directors*, W. Shepherd, G. Balfour, J. H. Guild.

Weston-super-Mare and District Electric Supply Co., Ltd., Locking Road, Weston-super-Mare, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Weston-s.-Mare; T.N., 79 & 181.] *Manager and Elec. Eng.*, G. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, E. R. Soames.

Wolverhampton District Electric Tramways, Limited, Tramway Depot, Bilston, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Bilston; T.N., 56, Bilston.] *General Manager*, W. G. Bond; *Sec.*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley, B. Kingsford.

Worcester Electric Traction Company, Ltd., St. John's, Worcester, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Worcester; T.N., 81.] *Engineering Manager*, R. Simpson; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. A. Lycett, B. Kingsford, W. S. Wreathall.

Wrexham and District Transport Co., Ltd., 6, Lord Street, Wrexham, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Wrexham; T.N., 182, Wrexham.] *Manager*, A. A. Hawkins; *Sec.*, J. R. Oliphant; *Acting Sec.*, J. S. Bowker; *Chairman*, J. V. Kitchener; *Directors*, G. J Somerville, W. S. Wreathall.

Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. [T.A., England, Belle Isle, Wakefield; T.N., 213.] *Gen. Manager and Sec.*, H. England; *Elec. Engs.*, C. J. Jewell and E. A. Wood; *Traffic Supt.*, W. J. McDonald; *Chairman*, Sir Herbert S. Leon, Bart.; *Directors*, B. Newgass, G. E. Leon, E. Remnant, W. Murray.

Yorkshire (Woollen District) Electric Tramways, Limited, Frost Hill, Liversedge, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Heckmondwike; T.N., 8 Heckmondwike.] *Secretary*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Sir Thos. Pilkington, E. A. Paris (*managing*).

TRAMWAY ASSOCIATIONS.

MUNICIPAL TRAMWAYS ASSOCIATION.

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(General Manager, Dundee Corporation Tramways).

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HENRY MOZLEY
(General Manager, Burnley Corporation Tramways).

Hon. Secretary and Treasurer:
C. J. SPENCER
(General Manager, Bradford Corporation Tramways), 7, Hall Ings, Bradford.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

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LIST OF ELECTRIC TRAMWAYS & RAILWAYS.

PARTICULARS OF TRACK AND EQUIPMENT.

TRAMWAYS, pp. xxvii-xxx. RAILWAYS, p. xxx.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No of Motor Cars.	No of Dynamos	No. of Engines	Type of Engines	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS.				ft. in.	lbs.	1 in	ft. rad.						
Aberdare Urban District Trys. ..	Oct., 1913	2·9	3·3	3 6	96 G	13	45	14	2	2	V.Cp.C.	400	Lanc. Dynamo Co.
Aberdeen Corporation	Dec., 1899	14·4	27·75	4 8½	96 G	13	42·5	83	*14	14	V.Cp.C.	4,610	British T-H. Macartney & Co.
Aberdeen Suburban Trys. Co. ..	June, 1905	5	5	4 8½	95 G	28	90	9	..	..	..	..	J. G. White & Co.
Accrington Corporation	Aug., 1907	7	10·66	4 0	95 G	14	..	32	*8	8	..	1,888	Brush Co.
Airdrie & Coatbridge Tramway Co.	Feb., 1904	3·63	4·94	4 8½	94 G	14	210	15	..	..	..	..	Brush Co.
Ashton-under-Lyne Corporation ..	Aug., 1902	7	8·15	4 7⅞	96 G	10	40	25	5	5	..	400	Dick, Kerr, & Co. Siemens Bros.
Ayr Corporation	Sept., 1901	6	7·612	4 8½	90 G	21	45	24	*8	8	..	400	British T-H.
Bacup Corporation	1910	1·50	2	4 8½	103 G	9	40	..	..	..	..	..	
Barking Town Urban District ..	Dec., 1903	2·6	3·125	4 8½	100 G	25	44	9	4	3	V.Cp.C.	200	Blackwell & Co.
Barnsley & Dist. Elec. Traction Co.	Nov., 1902	3·06	4·25	4 8½	97 G	10	60	13	*	..	..	..	J. G. White & Co. Brush Co.
Barrow-in-Furness	Feb., 1904	6·9	10·32	4 0	90 G	13	50	24	*8	..	..	..	Brush Co. Dick, Kerr, & Co.
Bath Electric Tramways, Ltd. ..	Jan., 1904	14·7	19·3	4 8½	95 G	10·7	38	40	4	4	H.T.Cp.	675	Westinghouse
Batley Corporation	Aug., 1903	6·536	10·47	4 8½	104 G	9	40	15	6	4	H. Cp.	240	B. I. W. Co. British Elc.Cr.Co
Belfast City	Dec., 1905	49·65	98·54	4 8½	105 G	15	35	291	3	3	Tri.Exp.	3,000	J. G. White & Co. Westinghouse
Bessbrook—Newry (1) .. .. Bessbrook and Newry Try. Co.	Oct., 1885	3	3	3 0	41 V	80	55	2 M 2 T	2	1	Hyd.Turb.	..	Mather & Platt
Bexley Urban District	Oct., 1903	5·25	6·5	4 8½	90 G	14	40	21	3	3	V. Cp.	600	Dick, Kerr, & Co.
Birkenhead Corporation	Feb., 1901	13·8	24·09	4 8½	100 G	13½	40	65	6	6	V. Cp.	..	Blackwell & Co. British T-H.
Birmingham Corporation	Jan., 1904	65·56	114·55	3 6	105 G	13	40	586	..	..	..	1,475	Dick, Kerr, & Co.
Birmingham and Midland Trys. Co.	Nov, 1904	10·32	16·45	3 6	85 & 94 G	15	31	62	6	6	Cp.	..	Brush Co.
Blackburn Corporation	March, 1899	14·67	24·75	4 0	92 G	15	30	61	*4	4	V.Cp.C.	..	British T-H. Blackwell & Co.
Blackpool Corporation	Oct., 1885	14·75	21·38	4 8½	96 G	20	36	84	5	..	Turb.	3,250	Elwell-Parker British T-H.
Blackpool & Fleetwood Tramrd. Co.	July, 1898	7·9	15	4 8½	70V 98G	26	80	41	5	5	V. Cp.	600	Mather & Platt D.K.&Co.-B.T-H.
Blackpool and Fylde Light Ry. Co.	Under cons.	14	14·5	4 8½	..	..	..	..	..	..	..	..	
Blackpool—St. Anne's & Lytham ..	May, 1903	7·47	14·03	4 8½	92 G	22	35	40	..	..	..	..	British T-H.
Bolton Corporation	Nov., 1899	26	47·21	4 8½	90G	14	35	112	*12	12	V.Cp.C.	3,800	Dick, Kerr, & Co. Blackwell & Co.
Bootle Corporation	May, 1900	4·125	7·75	4 8½	95 G	20	40	55	*8	8	..	4,000	Blackwell & Co.
Bournemouth Corporation	July, 1902	21·66	31·75	3 6	100 G 66 slot	10	40	91	5	4	V. Cp.	1,200	J. G. White & Co.
Bradford Corporation	July, 1898	59	108·75	4 0	102 G	9·8	40	‡272	11	11	V.Cp.C.	..	Westinghouse Blackwell & Co.
Bray and Enniskerry Railway Co.	Under cons.	3·25	5	3 6	..	..	..	..	..	..	..	..	
Brighton Corporation	Nov., 1901	9·48	17·18	3 6	105 B.S. No. 4	9	40	53	5	5	Turb.	1,000	Macartney & Co. Westinghouse Blackwell & Co.
Brighton Beach (1)	Aug., 1883	1·75	2	2 8½	35 V	100	80	9	2	..	..	..	Siemens Bros.
Bristol—Bristol Trys. Co.	Oct., 1895	31	57·5	4 8½	92½ G	10	30	232	6	4	V.Cp.C.	..	British T-H. and Blackwell & Co.
Burnley Corporation	Dec., 1901	12·50	22·16	4 0	102 & 107 G	9·8	35	67	*8	6	H.Cp.C.	1,500	British T-H.
Burton and Ashby Light Railway..	July, 1906	10·2	12·3	3 6	90 G	11	51	20	2	2	Diesel	330	Dick, Kerr & Co. Brush Co.
Burton-on-Trent Corporation ..	Aug., 1903	6·67	9·75	3 6	90 & 100 G	11·7	40	20	3	3	V. Cp.	400	Dick, Kerr, & Co. Blackwell & Co.
Bury Corporation	June, 1903	22·5	34·42	4 8½	102¾ G	12	40	54	6	6	..	1,500	Westinghouse
Camborne and Redruth	Nov., 1902	3·75	4	3 6	83 G	15	40	8	7	7	Cp.	1,525	Dick, Kerr, & Co. British T-H.
Cardiff Corporation	May, 1902	17·25	31·82	4 8½	100 G	23	35	130	9	9	V.Cp.C&T	2,200	British T-H. Dick, Kerr, & Co.
Carlisle, City of, Elec. Try. Co. ..	June, 1900	7·25	8·5	3 6	83 G	14	23	15	4	4	..	..	D.K.& Co.-B.T-H.
Cavehill & Whitewell Try. Co...	Feb., 1906	3·29	4·31	4 9	105 G	31	75	10	..	..	..	..	J. G. White & Co.
Chatham & District Light Rly. Co.	June, 1902	14·98	26	3 6	92½ & 105 G	9	35	50	5	4	H. Cp.	675	British T-H. Co. Brush Co.
Cheltenham and District ..	Aug., 1901	10·22	12·25	3 6	80 & 90 G	8·9	37	20	2	2	V. Cp.	..	Westinghouse
Chester Corporation..	April, 1903	3·59	6·4	3 6	94 & 100 G	23	40	18	*7	6 1	V. Cp.C. V. Tri. ExC	240	Blackwell & Co. British T-H.
Chesterfield Corporation	Dec., 1904	3·6	5·1	4 8½	96 & 101 G	20	40	17	4	4	V.Cp.C.	800	Milnes & Co. Westinghouse Brush
Clontarf and Hill of Howth ..	July, 1900	5·5	6·5	5 3	90 & 60 G	13	34	12	..	..	..	..	W.M. Murphy & Co.
Colchester Corporation	July, 1904	6	7·94	3 6	95 G	12	43	18	8	8	V. Cp.	1,140	Dick, Kerr & Co. J. G. White & Co.
Colne Corporation Tramways ..	Nov., 1903	5·2	6·7	4 0	102 G	13	60	13	*	..	..	..	Blackwell & B.T-H. Glover & Co.
Cork Elec. Try. & Lighting Co. ..	Dec., 1898	10	15	2 11½	83 G	14	26	35	*9	9	H.Cp.C.	570	British T-H. Blackwell & Co.
Coventry Corporation Tramways..	Dec., 1895	12·88	15·81	3 6	65 G 81 G	16	35	51	5	3	H.&V.Cp.	1,500	Westinghouse Blackwell & Co.
Croydon Corporation	Sept., 1901	11·87	19·12	4 8½	96·5 G	16	40	75	*13	13	..	2,000	British T-H. Co.
Darlington Corporation	June, 1904	4·875	8·88	3 6	90 G	14	52·8	18	1	..	..	250	Westinghouse

* Current from combined lighting and traction station. (1) Third rail system. † Includes 1·25 miles railless trolley line. ‡ Includes 20 railless cars.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Dartford U. D. C.	Feb., 1906	6·5	8·5	4 8½	100 G	12	35	12	4	..	..	..	British I. W.
Darwen Corporation	Oct., 1900	4·36	7·16	4 0	95 G	9	35	19	*4	4	H. Cp.	..	British T-H.
Derby and Ashbourne	..	14·5	..	4 8½									
Derby Corporation	July, 1904	13	22·06	4 0	95 G	14	46	50	3	3	Turb.	..	J. G. White & Co. / Brush & B.T-H.
Devonport Corporation	June, 1901	..	7	3 6	97 G	10	50	12	..	..	..	..	Blackwell & Co.
Doncaster Corporation	June, 1902	8·25	12·52	4 8½	94 G	16	45	32	8	8	..	1,000	Blackwell & Co.
Dover Corporation	Sept., 1897	4·75	7	3 6	87 & 90 G	10	44	24	*2	2	H.CC.	..	D. K. & B. T-H
Douglas—Port Soderick / Douglas Southern Elec. Trys. Co.	Aug., 1896	3·25	3·75	4 8½	65 V	12	45	8 M / 8 T	2	2	H. Cp.	200	Westinghouse / British T-H.
Dublin & Lucan Elec. Railway Co.	March, 1900	6·5	7	3 6	50 V	20	27	9 M / 5 T	2	2	H. Cp.C.	240	Dick, Kerr, & Co.
Dublin United Tramways Co.	May, 1896	49·8	95·26	5 3	105 G	12·3	22	365	8	8	Cp & Tur	5,500	Dick, Kerr, & Co. / Blackwell & Co. / British T-H.
Dudley and Stourbridge Trys. / British Electric Traction Co.	July, 1899	22·88	30·97	3 6	90 G	11	50	59	4	4	H. Cp.	..	British T-H. / Blackwell & Co.
Dumbarton	Feb., 1907	13	17	4 7¾	90 & 96	14	60	30	3	3	..	..	Dick, Kerr, & Co.
Dundalk	Under cons.	6	6·25	3 6	97 G	10	50	12					White & B.T-H.
Dundee, Broughty Ferry, and District	Dec., 1905	4·125	7·25	4 8½	90 G	16·5	30½	14	3	3	V. Cp.C.	..	J. G. White & Co. / British T-H. Co.
Dundee Corporation	July, 1900	16·3	30·25	4 8½	90 & 100 G	10	35	76	5	5	..	..	Blackwell & Co.
Dunfermline (Fife Try. & Power Co.)	Nov., 1909	14·6	17·4	..	90 G	10	25	28	..	..	..	..	British T-H.
East Ham Corporation	June, 1901	7·58	14·20	4 8½	90 & 105 G	25	40	45	*5	5	H. Cp.	750	Dick, Kerr, & Co.
Eccles Corporation	May, 1902	5	7·75	4 8½	100 G	..	..	..	..	..	..	..	
Edinburgh and District	June, 1910	1·25	1·5	4 8½	100 G	21	54	4	..	..	..	..	Dick, Kerr, & Co.
Erith Urban District Council	Aug., 1905	4·7	8·4	4 8½	100 G	17	40	17	3	5	..	..	Brush Co. / WestinghouseCo.
Exeter Corporation	April, 1905	4·875	7	3 6	90 G	11·5	35	24	*4	4	H. Cp.	..	Dick, Kerr, & Co.
Falkirk and District	Oct. 1905	7·81	10·5	4 0	90 G.	11·3	48	18	*	..	..	..	Bruce Peebles & Co. / British T-H.
Farnworth Urban District	Jan., 1902	4·33	7·16	4 8½	98 G	29	36	..	..	..	..	..	
Felixstowe Pier	Aug., 1905	0·5	0·5	3 6	36	..	..	3	..	..	..	..	
Gateshead and District	May, 1901	12·38	20·02	4 8½	90 G	8	35	55	*	..	..	..	Dick, Kerr, & Co. / Blackwell & Co.
Giant's Causeway Elec. Try. Co.	Sept., 1883	8	9	3 0	42 V / 75 G	24	30	5 M / 21 T	2	2	Hyd. Turb.	..	Siemens Bros. / British T-H.
Glasgow Corporation	Oct., 1898	99·26	198·13	4 7¾	110 G	11·93	30¾	857	8	8	V. Cp. & T	21,700	British T-H. / Westinghouse
Glossop Urban District	Aug., 1903	4·56	5·6	4 8½	90 G	13	40	8	4	4	V. Cp.	200	British T-H.
Gloucester Corporation Light Rly.	May, 1904	9	15	3 6	90 G	25	40	30	*2	2	Cp.	750	Brush Co. / Dick, Kerr, & Co
Gosport & Fareham Trys. Co.	Jan., 1906	7·5	11·5	4 7¾	96 G	16	37½	22	3	3	V. Cp. C.	750	Dick, Kerr, & Co.
Gravesend and Northfleet	Aug., 1902	6·5	9	4 8½	87 G	11	45	18	*				Brush Co.
Great Crosby	June, 1900	2·5	2·5	4 8½	92½ G	..	40	14	*7	7	H. & V. Cp.	160	Dick, Kerr, & Co. / Blackwell & Co.
Great Grimsby	Dec., 1901	6	11	4 8½	90 G	15	26	32 M / 6 T	3	3	..	400	Dick, Kerr, & Co.
Greenock and Port Glasgow	Oct., 1901	7·425	14·05	4 7¾	90 G	11	60	42	*	..	..	..	
Guernsey Railway Co.	Nov., 1892	3	3	4 8½	74 V / 84 G	60	60	9 M / 8 T	2	1	H. & V. Cp.	160	Siemens Bros. / British T-H.
Halifax Corporation	June, 1898	37·53	55·5	3 6	95½ G	9·5	38·6	101	*7	7	H. & V. Cp. & T.	3,000	Electric Cons. Co. / British T-H.
Hampshire Light Railway (Elec.) Co.	March, 1903	6	9	4 8½	..	..	..	10	*	..	..	..	
Haslingden Corporation	July, 1908	3	3	4 0	100 G	10	30	..	..	..	..	45	Dick, Kerr, & Co.
Hastings and District	July, 1905	19·33	34	3 6	90 G	8	30	65	6	6	V. Cp.	2,100	Dick, Kerr, & Co.
Herne Bay Pier (1)	March, 1899	·75	·75	3 0	60	..	..	3	1	1	Gas	50	British T-H.
Heywood Corporation	Dec., 1905	4·25	4·25	4 8½	90 G	17	..	..	1	1	..	300	Blackwell & Co. / B.I. & H.C. Co.
Houghton-le-Spring (See Sunderland Dist. Elec. Trys.)													
Huddersfield Corporation	Feb., 1901	34·50	56	4 7¾	98 G	11	35	106	4	4	V. Cp. C.	2,200	British T-H.
Hull Corporation	July, 1899	13·46	30·5	4 8½	94 G	20	30	180	7	7	V. Cp. C.	2,560	British T-H. / Westinghouse
Ilford Urban District	Mar., 1903	7·42	12·62	4 8½	95 G	13	33·3	28	*7	7	..	1,600	British T-H. / Dick, Kerr, & Co.
Ilkeston Corporation	May, 1903	3·8	4·3	3 6	90 G	12	28	13	..	..	..	..	Dick, Kerr, & Co.
Ipswich Corporation	Nov., 1903	10·8	14·87	3 6	90 G	11·5	40	36	*10	10	Enclos'd	1,175	Westinghouse
Isle of Man—													
Manx Elc. Rly. Co. Douglas to Ramsey	July, 1893	18	35·75	3 0	62½ V	24	90	34 M / 29 T	8	9	H. Cp.	1,300	Mather & Platt
Manx Elc. Rly. Co. Snaefell Mountain	Aug., 1895	4·5	9·5	3 6	56 V	12	90	6	5	4	H. Cp.	390	
Isle of Thanet Trys. & Ltg. Co.	April, 1901	11	20·67	3 6	90 & 100 G	11	38	59	*6	6	3 V. Cp. / 3 H. Cp.	800	British T-H. / Blackwell & Co.
Jarrow and District	Nov., 1906	2·54	3·42	4 8½	95 G	12·5	50	10	..	..	..	..	Brush Co. / B.I. & H.C. Co.
Kearsley Urban District	Jan., 1902	1·75	1·75	4 8½	95 G	20	..	..	..	..	..	..	Westinghouse
Keighley Corporation	Oct., 1904	3·5	6·11	4 0	95 G	25	60	12	*4	4	V.	200	Blackwell & Co. / Brush & B.T-H.
Kidderminster—Stourport / British Electric Traction Co.	May, 1898	4·6	4·87	3 6	75 G	14	45	13	*5	5	Stm Turb.	..	Brush Elc. Eg. Co.
Kilmarnock Corporation	Dec., 1904	4·18	5·5	4 8½	90 G	24	45	14	*3	3	..	250	Blackwell & Co.
King's Norton & Northfield U. D.	May, 1904	5·25	8·25	3 6	105 G	15 & 21	100 & 145	..	..	..	..	..	Blackwell & Co.
Kinver	April, 1901	4·25	6	3 6	63 & 90 G	..	..	6					
Kirkcaldy Corporation	Feb., 1903	6·11	8·56	3 6	100 G	11	40	26	*10	6	Cp. H.T.	2,290	British T-H. Co.
Lanarkshire Tramway Co.	July, 1903	28·431	43·120	4 7¾	96 & 101 G	9·4	37	76	4	4	3 H. Cp. / 1 V. Cp.	825	British T-H. Co.
Lancashire United Tramways Co.	Oct., 1902	39	54	4 8½	90 G	15	50	82	*8	8	V. Cp. C&T	7,000	B. I. W. Co.
Lancaster Corporation	Jan., 1903	4	4·81	4 8½	90 G	8	30	12	4	4	V. Cp.	200	Greenwood & Batley, Ltd.
Leamington & Warwick Elec. T. Co.	July, 1905	3·04	6·1	3 6	65 G	12	47	12	3	3	Cp.	..	Brush Co.
Leeds City	Aug., 1897	69·02	114·62	4 8½	105 & 111 G	8·4	32	345	5 / 3	5 / 3	H. Cp. C. / Stm. Tur	6,150	Elec. Con. Co. / Greenwood & Batley, British T-H. / Blackwell & Co.

* Current from combined lighting and traction station. (1) Third Rail system. M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Leicester Corporation	May, 1904	20·25	38	4 8½	100 G	16	35	160	7	7	V.Cp.C&T	9,250	Dick, Kerr, & Co. / Blackwell & Co.
Leith Corporation	Aug., 1905	9·08	17·9	4 8½	106·7 G	19	54	37	*11	11	..	1,600	Brush & B.T-H.
Leyton Urban District	Dec., 1906	8·95	17·694	4 8½	105 & 111 G	24	45	60	*4	4	Cp.T.E&T	2,040	..
Lincoln Corporation (1)	Nov., 1905	1·75	2·96	4 8½	100 G	..	36	8	*9	9	..	120	Blackwell & Co.
Liverpool Corporation	Nov., 1898	70	127	4 8½	95, 123 & 134 G	13	30	599	*42	42	Trip.Ex.	44,600	British T-H. / Dick, Kerr, & Co. / Westinghouse
Liverpool Overh'd Ry. (Trol.Ln.Ex.)	June, 1900	2·5	2·5	4 8½	92½ G	Nil	40	14	7	7	H.&V.Cp.	160	Dick, Kerr, & Co.
Llandudno and Colwyn Bay ..	Oct., 1907	8·37	13·60	3 6	90 G	11·5	45	18	*	..	..	..	Bruce Peebles & Co.
Llanelly and District	July, 1911	6·25	6·75	4 8½	90 G	11·2	60	12	*2	2	Trip.Ex.	..	British T-H.
London County Council (2) ..	May, 1903	148·56	287·35	4 8½	105 G	10·6	45	1725M 150T	8	8	V. Cp. C. Turbine	43,000	Dick, Kerr, & Co. / Westinghouse
London United Tramways Co. ..	April, 1901	55·25	102·45	4 8½	92½ & 100 G	18	28	339	7	5	V. Cp.	3,500	British T-H. / Westinghouse. / Blackwell & Co.
Lowestoft Corporation	July, 1903	4·75	5·07	3 6	100 G	27	36	19	*5	5	Cp.	..	Blackwell & Co.
Luton Corporation Tramways (Leased to J. G. White & Co., Ltd.) ..	Feb., 1908	5·25	6·25	4 8½	95 G	11	35	12	*1	1	..	..	J. G. White & Co. / British T-H.
Maidstone Corporation	July, 1904	5·5	7·04	3 6½	96 G	9	35	19	3	3	..	750	Dick, Kerr & Co.
Manchester Corporation	June, 1901	120·05	244	4 8½	105 G	14·9	35	685	*22	22	Turb'nes	45,300	British T-H. / Dick, Kerr, & Co.
Mansfield and District Co. ..	July, 1905	10	12·25	4 8½	90 G	17	50	24	*3	3	..	..	
Merthyr	April, 1901	3·69	4·81	3 6	96 G	11	66	16	*4	4	H.S.V.	..	D. K. & B. T-H
Metropolitan Electric Trys., Ltd.	July, 1904	56·25	112·5	4 8½	100 G	12	40	312	5	5	1 Stm. Tur	..	British T-H. / Brush Co.
Mexborough & Swinton Trys. Co.	Feb., 1907	7·75	10·75	4 8½	90 G	8·5	55	20	4	4	Turb.	700	Brush & B.T-H.
Middlesbro', Stockton, & Thornaby Electric Tramways Co.	July, 1898	10·5	15·825	3 6	92½ G	17	35	60	3	4	H.&V.Cp.	900	British T-H. / Blackwell & Co.
Middlesex County Council	Aug., 1904	25·5	51	4 8½	..	..	..	..	..	..	..	..	
Middleton Corporation	March, 1902	2·5	5	4 8½	..	..	..	..	..	..	..	..	
Middleton Electric Traction Co. ..	March, 1902	8·5	10·53	4 8½	90 G	15	49½	28	3	3	..	500	Glover & Co.
Morecambe	Jan., 1912	1·20	..	4 8½	96 G	18	..	4	..	..	..	..	
Musselburgh and District ..	Dec., 1904	6·5	8·125	4 8½	90 G	34	45	16	4	3	..	400	B. T-H. Co., Nat. Elec. Cons. Co.
Nelson Corporation	Feb., 1903	2·74	3·86	4 0	106 G	11	41	11	*4	4	..	400	Blackwell & Co. / British T-H. Co. / Brush Co.
New St. Helens & District Trys. Co.	July, 1899	18	20	4 8½	95 G	13	35	36	*4	4	V. Cp. C.	..	Westinghouse / British T-H.
Newcastle Corporation	Dec., 1901	32·75	62·875	4 8½	101 G	11	37	220M 2 T	6	6	V. Cp. Trip. Ex. & Turb.	11,000	Westinghouse / British T-H.
Newport (Mon.) Corporation ..	April, 1903	7·5	14·35	4 8½	98 G	10·5	40	44	5	5	V. Cp.	1,750	Westinghouse
Northampton Corporation	July, 1904	6·5	11·16	3 6	90 & 96 G	18	50	33	4	4	V.C.C.&T	1,020	Dick, Kerr, & Co. / Brush Co.
North Shields Tramways Co. ..	March, 1901	..	7·75	3 6	90 G	10	36	22					
North Staff. Trys. (*vide* Potteries)													
Norwich Electric Tramways Co. ..	July, 1900	14·5	19·25	3 6	65½ & 90 G	12·6	38	42	6	5	H.TCp&T	1,000	Westinghouse / Blackwell & Co.
Nottingham Corporation	Jan., 1901	21·5	41·5	4 8½	107 G	11·5	40	155	*3	3	..	..	British T-H. / Dick, Kerr, & Co.
Nottinghamshire & Derbyshire Tramways Co.	Aug., 1913	12·8	16·10	4 8½	G	..	..	24	*	..	..	..	British T-H.
Oldham, Ashton & Hyde Trys. Co.	June, 1899	9·12	11·75	4 8½	97 G	11	28	46	*3	3	V. Cp. C.	..	British T-H.
Oldham Corporation	Dec., 1900	24	37	4 8½	100 & 105 G	10·5	40	109	*4	4	..	2,220	Dick, Kerr, & Co.
Paisley & District Tramways Co.	June, 1904	18·25	32·50	4 7¾	90 G	10	34	60	..	..	..	..	British T-H.
Perth Corporation	Oct., 1905	4·846	6·75	3 6	90 G	16	25	12	5	5	Cp.	500	Blackwell & Co.
Peterborough Elec. Traction Co. ..	Jan., 1903	5·33	6·71	3 6	94 G	31	35	14	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co.
Plymouth Corporation	Sept., 1899	7·75	15	3 6	92 G	9	*35	42	3	3	V. Cp.	..	Elec. Cons. Co. / Westinghouse
Plymouth, Stonehouse, and Devonport	Nov., 1901	1·5	3·62	3 6	84 G	11	34	15	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co.
Pontypridd Urban District ..	March, 1905	5·5	8·6	3 6	96 & 100 G	10	27·6	26	4	5	V.C.Cp.	450	B.I.W. & B.T-H. / Blackwell & Co.
Portmadoc & South Snowdon Rly.	Under cons.	13·25	15	1 11½	41	28	200	6	..	..	..	..	
Portsdown & Horndean Tramway	March, 1903	6	7·5	4 7¾	96 G	16	40	16	2	2	Oil	200	Dick, Kerr, & Co. / Brush Co.
Portsmouth Corporation	Sept., 1901	17·65	34·63	4 7¾	96 & 100 G	17	35	100	5	4	V. & H.Cp.	2,075	Macartney & Co. / Dick, Kerr, & Co.
Potteries Electric Traction Co. ..	May, 1899	31·67	41·48	4 0	87, 90, 100, & 110 G	11	45	110	8	8	H.Cp. / V.Cp.	2,275	Dick, Kerr, & Co. / Blackwell & B.T-H.
Preston Corporation	June, 1904	10·54	17·2	4 8½	B.S.S. No. 2	16	28	39	2	2	H. Cp.	600	Dick, Kerr, & Co.
Radcliffe Urban District ..	April, 1905	5	6·5	4 8½	100 G	15	40	..	*4	4	V. Cp.	600	Mather & Platt
Rawtenstall Corporation	May, 1909	12	15·9	4 0	100 G	15	38	24	*3	3	..	850	Westinghouse
Reading Corporation	July, 1903	7·44	13·175	4 0	96 G	16	35	36	4	4	V. Cp.	400	Blackwell & Co. / Dick, Kerr, & Co. / Westinghouse
Rhondda Tramways Co.	July, 1908	21	28·75	3 6	95 G	9	38½	54	7	4	Trip.Ex.	1,230	British T-H. / Brush
Rochdale Corporation	May, 1902	19·58 (A)	22·74 (A)	4 8½	103½ G	11·7	30	69	*	..	..	..	British T-H. / Dick, Kerr, & Co. / Brush Co.
Rotherham Corporation	Jan., 1903	10	12	4 8½	100 G	9·5	45	36	*6	6	H.S.Cp.	1,485	Dick, Kerr, & Co.
Rothesay	June, 1902	4·81	9·68	3 6	94 G / 77 G	24	34	20	3	3	V. & Oil	350	Dick, Kerr, & Co. / Westinghouse
Ryde Pier, Isle of Wight Ryde Pier Co. (3) ..	March, 1886	·5	1	4 8½	30 & 34 V	..	..	4	2	2	Gas	..	Siemens Bros.
Salford Corporation	Oct., 1901	41·90	75·79	4 8½	103 G	20	42·5	220	*7	7	C. & Turb.	3,000	Westinghouse / Mather & Platt
Scarborough Tramways Co. ..	May 1904	5	7·75	3 6	90 G	10·5	35	22	2	2	Stm. Turb.	..	Brush & B.T-H.
Sheerness and District	April, 1903	2·5	2·704	3 6	94 G	43	40	8	6	5	V.Cp.C.	100	Siemens & Halske / Brush Co.
Sheffield Corporation	Sept., 1899	40	77·84	4 8½	110 & 120	9·5	35	339	..	..	..	..	British T-H

* Current from combined lighting and traction station. (1) G.B. surface contact system. (2) Mainly Conduit system, but there are now several Trolley lines. Besides the electric lines the London County Council has also 4·45 route miles of horse tramways. (3) Third rail system. (A) Not including 1·71 miles track leased.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS (contd.).	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
				ft. in.	lbs.	1 in	ft. rad.						
Shipley Urban District	May, 1902	6	10	4 0	98 G	15	..	..	6	6	Turbine	1,800	British T-H.
Soothill Nether U.D.C. & Dewsbury & Ossett Corporations ..	Nov., 1908	3·125	4·45	4 8½	90 G	13	50	8	*	..	..	..	Nat. Elec. Cons. Co.
Southampton Corporation	Jan., 1899	10·25	18·75	4 8½	{96 G & 105 B.S.No.4}	13	40	73	6	6	H. Cp. C.	1,000	Westinghouse
Southend Corporation	July, 1901	7·01	13·52	3 6	90 G	18	48	42	*6	7	V. Cp.	2,075	British T-H.
Southend Pier (1) Southend Corp.	Aug., 1890	1·25	1·25	3 6	60 G	Lev.	..	28	..	..	..	..	British T-H.
South Metropolitan Elec. Try. Co.	Feb., 1906	13·09	26	4 8½	95 G	16	42	51	*8	6	Stm Tbs	1,650	{Dick, Kerr & Co. Brush Co.
Southport Corporation (5)	July, 1900	13·5	10·75	4 8½	87 & 90 G	25	45	30	*3	3	H. Cp.	600	Dick, Kerr, & Co.
Southport Electric Tramway Co...	July, 1901	8·17	12·52	4 8½	87 G	Nil	40	21	*				
Southport Pier	1905	..	·75	4 0	..	..	..	1 M 2 T	..	..	..	..	Westinghouse
South Shields Corporation ..	March, 1906	5·7	10·25	4 8½	95 G	15	35	40	2	2	V. Cp. C.	1,100	Dick, Kerr & Co.
South Staffordshire	Jan., 1893	16·90	26·87	3 6	97 & 90 G	17	46	46	3	3	C. H. Cp.	..	{Blackwell & Co. E. C. C.
Stalybridge, Hyde, Mossley, and Dukinfield	May, 1904	21·186	27·75	4 8½	99 G	9	27½	59	8	..	Turb.	1,000	Dick, Kerr, & Co.
Stockport Corporation	Aug., 1901	16	27·62	4 8½	96 G	10·8	35	50	*5	5	Cp.	1,000	Dick, Kerr, & Co.
Sunderland Corporation	Aug., 1900	10·92	20·35	4 8½	96 G	12	36	70	*	..	..	936	Dick, Kerr, & Co.
Sunderland District Electric Trys.	June, 1905	14·27	15·97	4 8½	90 G	11	40	33	*	..	..	..	British T-H.
Sutton & Howth (G.N.R., Ireland)	June, 1901	5·3	6	5 3	72 B	16·7	300	11	3	3	V. Cp.	500	{British T-H. Westinghouse
Swansea Tramways Company ..	June, 1900	13·02	20·38	4 8½	84 & 86 G	14	45	75	3	3	H. Cp. C.	620	British T-H.
Swindon Corporation	Sept., 1904	3·7	4·4	3 6	105 G	14	37	12	5	4	..	600	Dick, Kerr & Co.
Taunton Electric Traction Co.	Aug., 1901	1·66	2	3 6	90 G	25	35	6	*	..	..	..	Blackwell & Co.
Torquay Tramways	April, 1907	9·76	17·04	3 6	90 G	10	31	33	*	..	..	..	British T-H.
Trafford Park Estates, Ltd. (Trys.)	July, 1903	2·5	2·75	4 8½	100 G	Nil	35	..	..	..	..	..	
Tynemouth and District	March, 1901	4·21	7·83	3 6	90 G	10	30	21	*3	3	..	..	Blackwell & B.T-H.
Tyneside Tramways & Tramroads Co.	Sept., 1902	10·97	16·23	4 8½	95 G	10	40	24	*				
Wallasey Corporation	March, 1902	12	20	4 8½	98 G	11	40	67	*1	1	Turbine	1,000	Blackwell & Co.
Walsall Corporation	Jan., 1904	13·5	19·5	3 6	90 & 92 G	18·5	32	39	*7	7	V. & Tur.	2,490	British T-H.
Walthamstow U.D.C. Light Rly...	June, 1905	9·14	12·53	4 8½	100 G	18	40	38	*15	12	{Gas & Turb's}	1,560	Westinghouse
Walton-on-Naze Pier	Aug., 1898	·5	·5	3 6	36 V	..	..	3	3	2	..	100	{Blackwell & Co.
Warrington Corporation	April, 1902	6·5	9·6	4 8½	90 G	27	50	21	*6	6	V.C.	500	British T-H.
Wemyss and District	Aug., 1906	7·5	13	3 6	{95 & 97 G}	18	85	17	3	3	2 V. Cp.	..	Bruce Peebles & Co
West Bromwich Corporation ..	Dec., 1902	7	12·5	3 6	98 G	20	49	29	8	8	Turb'nes	750	{Dick, Kerr, & Co. B. I. W. Co.
West Ham Corporation	Feb., 1904	16·8	30·0	4 8½	100 G	18	40	118	*3	3	V.C. Cp.	1,500	Brush & B.T-H.
West Hartlepool Corporation ..	May, 1896	6·72	8.3	3 6	87 & 90 G	15	35	25	*	..	..	..	{Elec. Cons. Co. Dick Kerr & Co.
Weston-super-Mare	May, 1902	2·92	3·53	4 8½	90 G	25	40	12	5	4	Cp. & T.	..	{Blackwell & Co. British T-H. Brush Co.
Wigan Corporation	Jan., 1901	30·9	45·42	{3 6 / 4 8½}	105 G	12	45	73	*8	8	..	740	Blackwell & Co.
Wolverhampton Corporation (3) ..	April, 1902	13·5	22	3 6	91 G	15	37·5	52	*10	10	{H. & V.C. & Turb's}	2,900	{British T-H. Electric Cons. Co.
Wolverhampton District	Oct., 1900	15·51	22·72	3 6	90 G	20	40	30	*4	..	..	..	{B.I.W. & B.T-H.
Worcester Electric Traction Co. ..	Feb., 1904	5·86	8·58	3 6	94 G	13	45	15	*3	3	..	..	{Westinghouse Brush Co.
Wrexham and District	April, 1903	4·44	6·16	3 6	96 G	9·11	50	10	*6	..	..	..	Dick, Kerr, & Co. British T-H.
Yarmouth Corporation	June, 1902	10	14·4	3 6	90 & 95 G	27	48	35	3	3	Comp.	..	{Brush Co. B.I.W. Co.
York Corporation	Jan., 1910	6	9·9	3 6	100	18	40	3 M. 4 T.	*8	8	V.C.	..	{Dick, Kerr, & Co. Brush & B.T-H.
Yorkshire (West Riding)	Aug., 1904	24·69	40·382	4 8½	96 G	15·5	40	69	9	6	..	1,800	Dick Kerr & Co.
Yorkshire Woollen District ..	Feb., 1903	22·25	36	4 8½	{94 & 100 G}	8	30	69	*	..	..	..	{Brush Co. Dick, Kerr, & Co.
RAILWAYS.													
LONDON AND VICINITY:													
Central London Rly. Co. (1) ..	July, 1900	6·5	13	4 8½	100 V	30	..	68 M. 172 T.	6	6	H. Cp. C.	..	British T-H
City & South London Rly. Co. (1	Dec., 1890	7·25	14·75	4 8½	{60 V / 80 V}	30	120	52 L. 142 T.	(a)	..	..	..	{Mather & Platt. Elec. Cons. Co.
East London Railway (2) ..	April, 1913	5·75	11·5	4 8½	90 B	..	..	(c)	..	..	..	..	British T-H.
Gt. Northern & City Rly. Co. (2)	Feb., 1904	3·5	7·75	4 8½	85 V	52	660	35 M 45 T	6	..	..	..	British T-H.
Great Western Railway .. (Hammersmith and City line.)	Nov., 1906	4·9	10·5	4 8½	97½ B	60	400	40 M. 80 T	10	10	V. Cp.	..	{British T-H. Elec. Con. Co.
London & North Western Rly. (Euston-Watford line in progress) (2)	May, 1914	41·5	80	4 8½	..	..	..	..	..	..	Turbine	..	{Siemens Works Westinghouse
London & South Western Rly. (Extensions in progress) (1)	Under cons.	47	150	4 8½	..	..	168	84	..	..	Turbine	..	{Dick, Kerr & Co. British T-H.
London, Brighton, and South Coast Railway (4) .. .. (Extensions in progress)	Dec., 1909	22	70	4 8½	..	..	..	16 M. 8 T.	*(d)	..	..	..	{Westinghouse British T-H. Blackwell & Co.
London Electric Railway Co.: Baker St. & Waterloo Ry. (2)	March, 1906	7	14·0	4 8½	90 B	60	330	36 M. 72 T.	(a)	..	..	..	{Westinghouse British T-H.
Charing Cross—Hampstead Railway (2)	June, 1907	8	16·5	4 8½	90 B	33	330	60 M. 90 T.	(a)	..	..	..	{Westinghouse British T-H.
Great Northern, Piccadilly & Brompton Rly. (2)	Dec., 1906	9·25	18·5	4 8½	90 B	33	330	72 M. 144 T.	(a)	..	..	..	{Westinghouse British T-H.
Metropolitan Railway (2) ..	Jan., 1905	26	59	4 8½	86 B	44	363	86 M. 172 T	4	4	Turbine	..	{Westinghouse British T-H.
Metropolitan District Railway (and running powers) (2)	July, 1905	41	80·46	4 8½	86 B	40	330	234 M. 296 T.	(a)	..	Turbine	..	{British T-H. Westinghouse
Waterloo and City Rly. (1) ..	Aug., 1898	1·5	3	4 8½	87 B	30	321	17 M. 12 T.	6	6	V. C.	..	{Siemens Bros. Dick, Kerr & Co.
PROVINCES:													
Lancashire and Yorkshire (2) .. (Extensions in progress)	March, 1904	43	85	4 8½	86 B	85	840	88 M. 52 T.	6	5	{1 V.C. 4 H.C.}	..	Dick, Kerr, & Co.
Liverpool Overhead Rly. Co. (1)	March, 1893	6·5	13·05	4 8½	60 V	40	429	46 M 7 T	7	7	{H.Cp. V.Cp.}	..	{Electric Cons. Co. Dick, Kerr, & Co.
Mersey Railway (1)	April, 1903	4·5	9	4 8½	86 B	27	528	24 M. 87 T.	5	5	V.Cp.	..	{Westinghouse Elec. & Mfg. Co.
Midland Rly.—Morecambe and Heysham Branch (4)	June, 1908	9·75	19·5	4 8½	..	..	..	3 M. 6 T.	4	4	Gas.	..	{Westinghouse Siemens Bros.
N rth Eastern Railway (1) ..	March, 1904	35	80	4 8½	90 B	55	792	60 M. 50 T.	(b)	..	..	..	British T-H. Co.

*Power from combined lighting and power station. (1) Third rail system. (2) Third and fourth rails system. (3) Lorain surface contact system. (4) Single phase.
(5) Not including 9 miles owned but leased. (a) Power supplied by Chelsea Power Station (80,000 H.P.) (b) Power purchased from the Newcastle-upon-Tyne Electric Supply Company, Limited. (c) Rolling stock supplied by Metropolitan Railway. (d) Power supplied by London Electric Supply Corporation.
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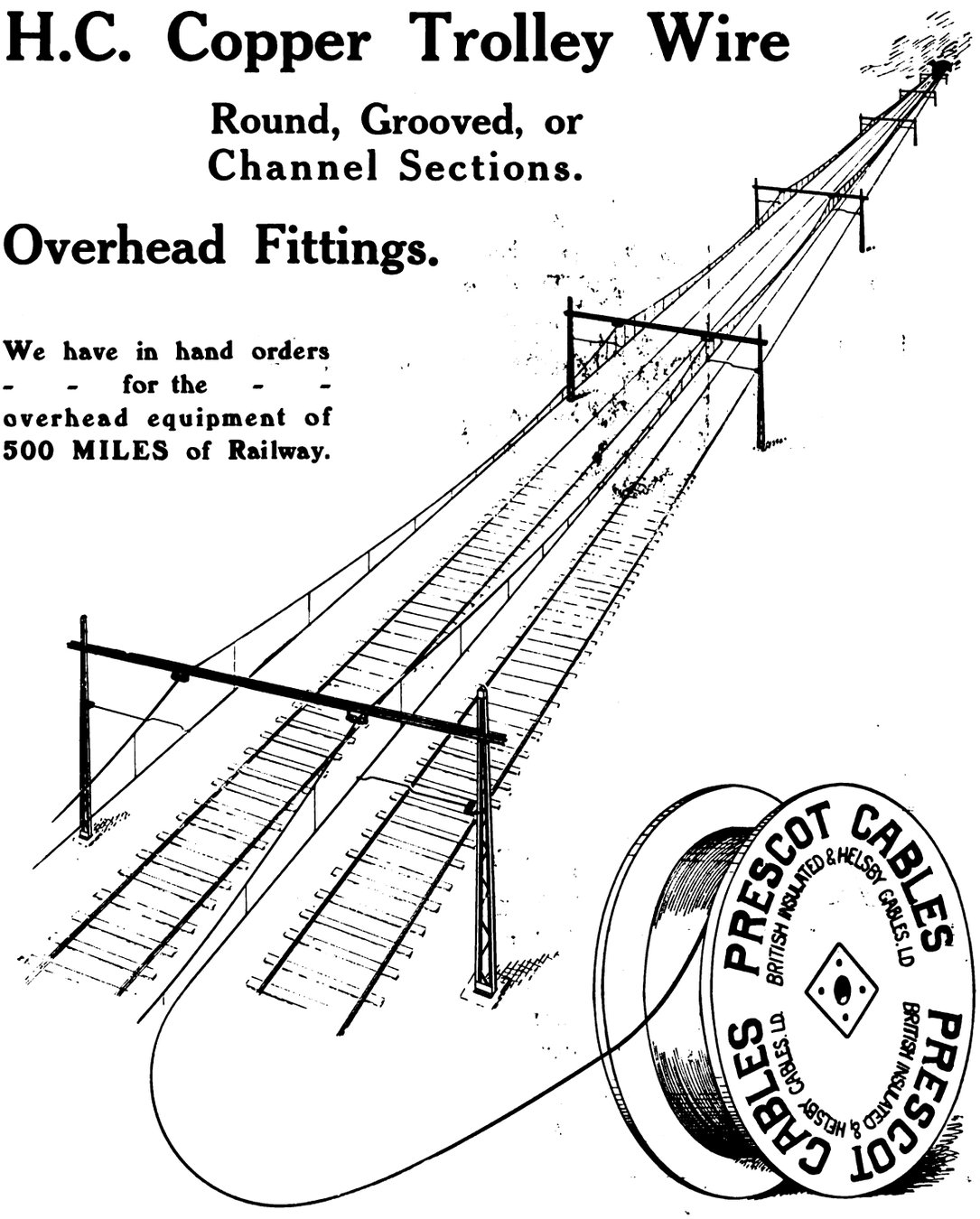

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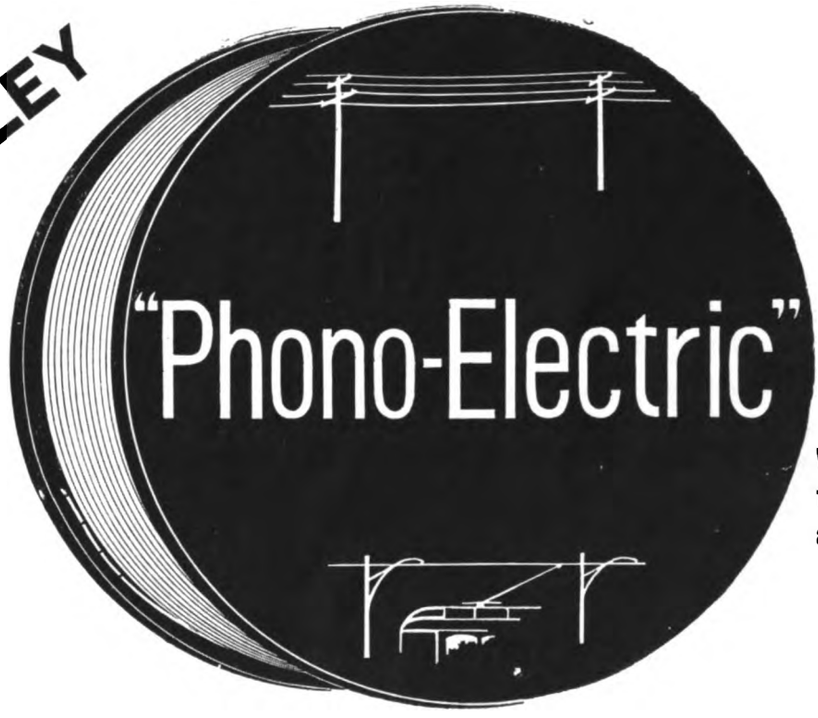

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, MAY 11, 1916. VOL. XXXIX.

PARIS MUNICIPAL TRAMWAYS ELECTRIFICATION.

PROGRESS OF A CONVERSION BEGUN IN 1911 AND INTERRUPTED BY THE WAR.

Owing to the war the great work of transforming the Paris Municipal Tramways from a varied collection of traction systems to the general use of electric trolley and conduit, which was begun in 1911, has progressed but slowly towards completion. Fortunately a good deal of the conversion work was carried out during 1912 and 1913, and as this includes the most important tramways in the Paris area, the present time is opportune for a survey of the work already completed.

Before entering upon such a description, reference may be made to the working results recently published of the leading Paris traction company during the years 1914-1915, viz., the Paris General Omnibus Company, who are the lessees of the municipal tramways. On the outbreak of war the motor omnibus services ceased entirely at 5 p.m. on Saturday, August 1, 1914, the whole of the vehicles being requisitioned for military purposes. The company's tramway services were disorganised by the mobilisation of the greater part of the staff, and for some months not more than half of the 28 routes worked by the company could be served. Six out of the eleven depots were also closed, and the daily car kilometres run dropped from 86,991 to 24,608, a decrease of 37,577 miles.

Fig. 1.—Conduit Tramways Under Construction in Trinity Place, Paris, in 1913.
Motor Omnibuses of the Type in Use before the War.

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By strenuous efforts the services were gradually re-established to some extent; four of the closed depots were again opened, and the daily car kilometres raised to 56,886 in December, 1914, and 67,103 by May, 1915. Out of 12,000 workpeople employed, more than two-thirds had been mobilised, and as many as 817 motormen out of a staff of 948, the company being obliged to train nearly 700 new men during the above period. More than 600 women—wives or daughters of mobilised employees—are employed in cash-taking and checking.

Fig. 2.—Paris Omnibus of 1828.

Nearly all the motor omnibus garages and former horse depots have also been requisitioned by the military authorities, while the central workshops, which are thoroughly well equipped and organised, have contributed very largely to munition work.

Total receipts for the year 1914 from omnibuses and tramcars amounted to 43,040,198 francs—a sum nearly 27 per cent. less than the total for 1913, this reduction being entirely due to the war and consequent dislocation of traffic. The omnibus kilometres amounted to 23,356,028 (equal to 14,597,517 omnibus-miles), the receipts being 21,344,558 francs. The average receipt per omnibus kilometre was 91·39 centimes (equal to 1s. 2¾d. per omnibus mile); the omnibus passengers totalled 151,919,920. The car kilometres for the year reached a total of 26,357,729, giving receipts of 21,695,640 francs, and an average of 82·31 centimes per car kilometre (equal to 1s. 1d. per car mile), carrying a total of 174,887,247 passengers.

Fig 4.—Three-Wheeled Omnibus—An Early Parisian Type.

A comparison between the state of affairs at August 1, 1913, and the same date in the following year shows that up to the last-named date the enterprise was making steady progress, with excellent results both from tramways and motor omnibuses, even allowing for the difficulties inherent to a transition stage in the traction systems employed. If it had been possible to complete the entire network in the time estimated under normal conditions, the final results for the year would have been exceedingly satisfactory. As it is, the management may be congratulated on achieving such an excellent result as is given by the final figures, which show a net profit of 7,066,149 francs, the total expenses being 36,747,887 francs.

Despite the difficulties of labour shortage and high cost of materials, several of the new lines and sections have been brought into use during the year.

Development of the Tramways Since 1856.

For the following description of the Paris General Omnibus Company's tramways undertaking we are largely indebted to a paper read before the Society of Civil Engineers in Paris by Monsieur A. Mariage, general manager of the omnibus company, who two years ago was consulted by the London County Council with reference to the extension of their tramways at terminal points in the central districts. Monsieur Mariage traces the history of street omnibus and tramway traffic from 1828, when the first omnibus services were begun. Some of the vehicles then used are illustrated in Figs. 2, 3, and 4. In 1855 the ten separate companies amalgamated to form one undertaking, which took the title of General Omnibus Company, a name still continued, but embracing the operation of tramways as well as omnibuses. For the first ten months of working the passengers carried were 40,000,000, and the receipts £334,500. By the year 1909 the traffic had increased to 114,795,000 passengers, or nearly threefold, on the omnibus routes only, quite apart from the tramway services of a later growth. There were then 43 omnibus routes in operation, of which 36 were worked by horse vehicles and seven by motor omnibuses, over a total route distance of 160 miles. The receipts were £854,000, and the omnibus

Fig. 3.—Paris Omnibus about 1828.

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miles 14,900,000. Figs. 5, 6, 7, and 8 represent types of conveyances thus operated during the period from 1855 to 1879.

The tramway section of the General Omnibus Company's business dates back to the year 1856, when a concession was transferred to the company for three lines of street railway starting from the Louvre, of which one was to reach the Rondpoint in the Bois de Boulogne. The second gave a service to Sèvres, and the third to Vincennes, a total distance

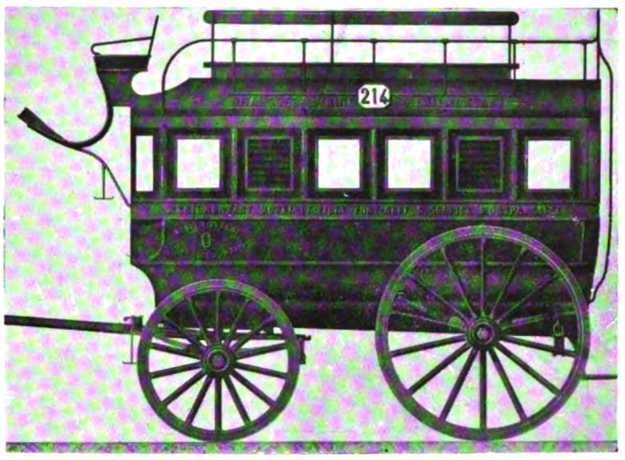

Fig. 5.—Omnibus for 24 Passengers (1855).

for the three of a little over 19 miles. Under this concession tracks from the Rondpoint and Sèvres were laid as far into Paris as the Place de la Concorde in 1858, but beyond this point it was considered by the authorities that the Imperial and other vehicles using the roadway in front of the Tuileries would be inconvenienced too much by the presence of rails in the street.

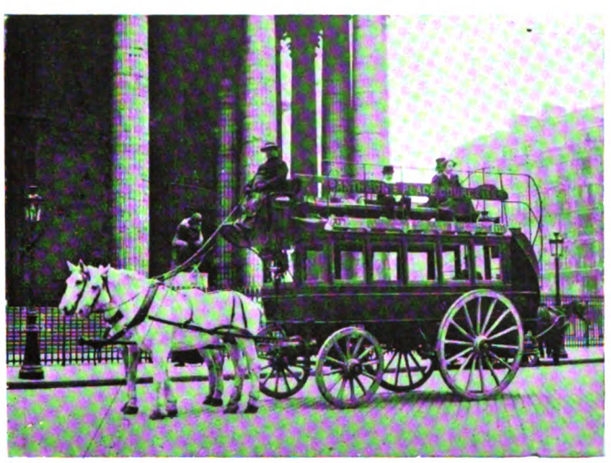

Fig. 7.—Omnibus for 30 Passengers (1866).

In 1866 the tramway vehicles were allowed to pass as far as the Palais Royal on condition that the flanged wheels were changed to flat-tired at the Place de la Concorde on the journey inwards and *vice-versa* on return. A third horse was also necessary at the same time on the "omnibus" section, owing to the increased road resistance. Some of our readers will be reminded by this of a method that was used in this country during the early seventies, by means of which ordinary horse omnibuses were able to use tramway rails through a small guiding wheel, which ran in one of the grooves and could be depressed or raised at will by the driver with a foot lever.

The first cars on these early tramways had 44 seats; succeeding types were built of capacities for 24, 40, 42, and 48 passengers. Figs. 9 and 10 are instances of the vehicles employed, with 40 and 51 seats respectively. The latter date from 1875, and were in use up to the time when animal traction was replaced by mechanical working. By the year 1900, without counting the special services established on account of the Exhibition, there were 36 tramway routes, aggregating 146 miles. The annual car mileage reached 12,750,000, and the passengers carried 155,976,000,

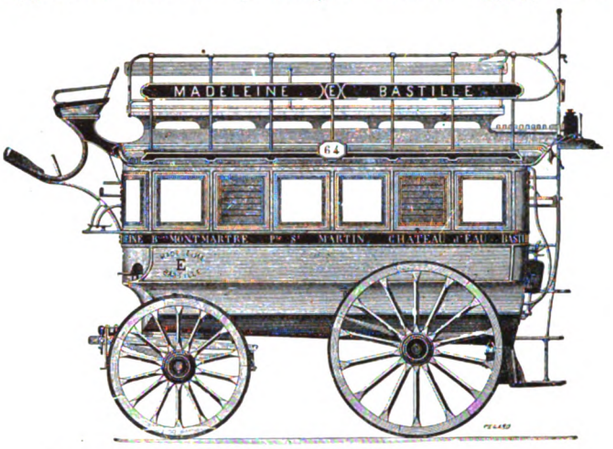

Fig. 6.—Omnibus for 26 Passengers—1866 Model.

total receipts being £1,050,000. The number of cars then in use was approximately 530. In 1909 three routes had been abandoned and two others amalgamated, leaving 32 in actual work, with an annual car mileage of 15,100,000 (passengers carried 138,451,628) and total receipts £895,000, the number of cars being 625.

The following figures relate to the year 1912:—

Fig. 8.—Three-Horsed Omnibus for 40 Passengers (1879).

Number of depots, 44; number of horses, 3,081; number of horse omnibuses, 135; number of motor omnibuses, 602; number of horse tramcars, 61; number of motor tramcars, 564; receipts, £2,045,000; staff employed, 13,094; passengers carried, 365,668,834; average receipts per passenger, 1·335d.

Delay in Electrification.—Compressed Air and Steam Experiments.

The foregoing figures show to some extent the practical results of the comprehensive conversion work then in full swing, and also indicate that it was not completed, there being still a small number of horse

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cars at work. The reason for this tardy transformation must be assigned to the fact that up to 1910 the company did not know whether or no the concessions under which they were operating would be renewed. Hence the work of conversion could only be commenced in

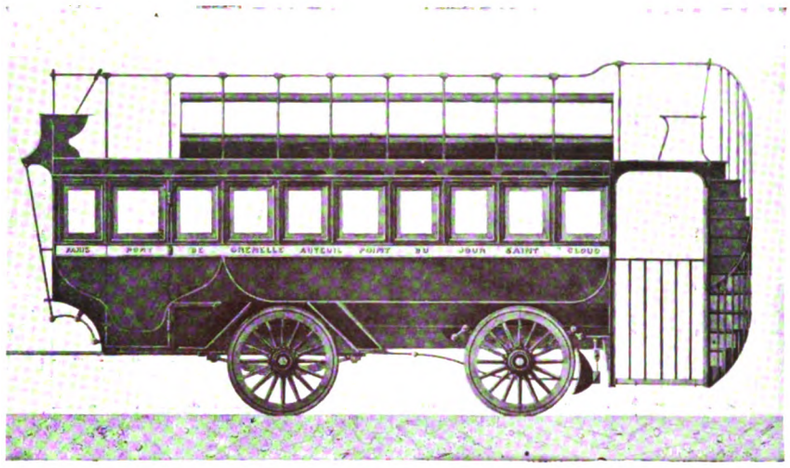

Fig. 9.—Omnibus for 40 Passengers (1866).

1911. The period embodying the twenty years between 1889 and 1910, when the concessions were definitely renewed, offers great interest owing to the number of systems of mechanical traction that were tried one after the other. At the time of the 1889 Exhibition, several Rowan steam cars were employed on special routes. An illustration of one of these is given in Fig. 11.

Although some of this type were in use up to 1910, the company had from their first experiences with steam traction no hope of its general use. The remaining short period of the concessions prevented any consideration of the electric conduit system being installed by the company, while overhead wires were out of the question.

Accordingly the company experimented with compressed air, and cars built under the Mekarski patents were put into service in 1894. Fig. 12 illustrates one of these vehicles. The practical difficulties of daily working and the high costs of compressed air locomotives forced the company into other experiments,

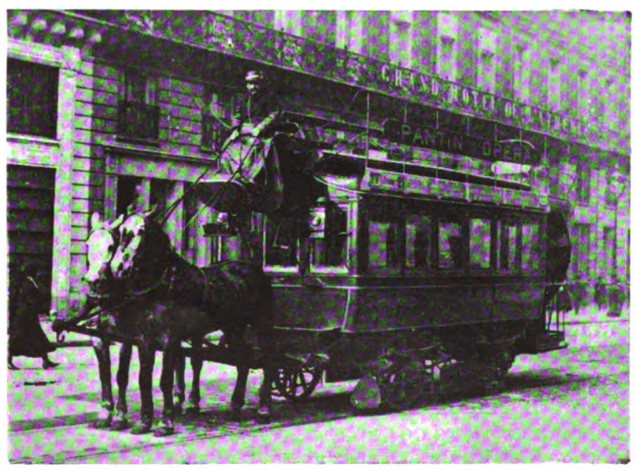

Fig. 10.—Omnibus with 51 Seats (1875).

and in 1897 they began to use Serpollet steam cars (Fig. 13). Later on these were largely replaced by steam motors of the Purrey type (Figs. 16 and 17), and meanwhile, as a means of competing satisfactorily with the Metropolitan and other tramways, where mechanical traction had been adopted from the outset, still further experiments were made with improved types of compressed air motors as well as with accumulator cars. These are illustrated in Figs. 14 and 15, both these systems being introduced about 1898.

In 1910 the concessions were renewed, and it became possible to plan a comprehensive transformation to electric working. It had taken the Ministry of Public Works and the Municipal Council from 1903 to 1910 to recognise the need for placing in the hands of one single interest the concessions for motor omnibus services, and for the new lease of the municipal tramways of Paris and of the Department of the Seine in the hands of the city of Paris. The estimates of working results on the tramways were calculated not only to give a reasonable return on the capital outlay but also an additional source of profit, which, added to the net revenue from the motor omnibuses, would justify a concurrent large capital outlay upon the latter. There was no hesitation on the part of the company in deciding at once upon electric traction with overhead wires where these were permitted, and conduits elsewhere.

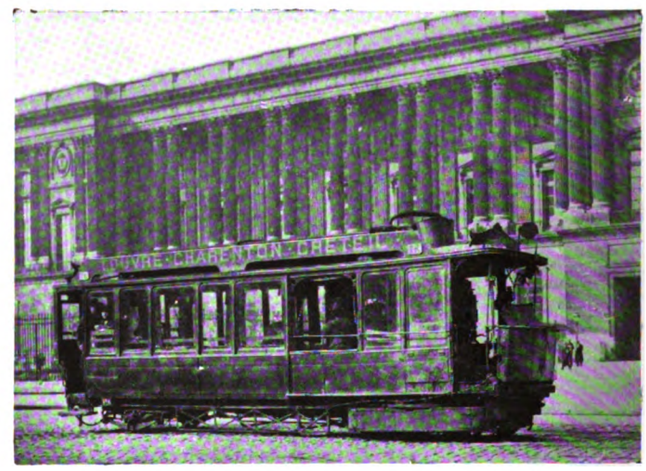

Fig. 11.—Steam Car—Rowan System—of 1889.

Routes, Depots, and Three Power Stations.

The sketch map (Fig. 20) shows the various lines forming the company's network, there being in all 34 routes with a total distance of 171·5 miles. In the plan the double lines show the portions equipped with conduit, the single lines representing the tracks where overhead wires are installed. There are 13 depots (shown on the plan by large double circles), with accommodation for over 1,300 cars (motor and trail), and at three of them are erected sub-stations in connection with the supply of electric power. The plans and specifications for all the depots were prepared by the company's engineering and other staffs, and were carried into execution under their supervision by outside contractors. The total outlay upon buildings alone has been not less than £320,000.

Fig. 19 shows the interior of one of the car-sheds at the Alfort depot, and illustrates very clearly the mode of constructing the tracks and inspection pits. One interesting feature of the design is that the gangways between tracks are lowered about 18 inches below rail level, thus helping very materially in the inspection of brakes and running gear generally.

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Heavy repairs and renewals are all carried out at the central workshops, both as regards the tramcars and the motor omnibuses. This part of the installation remaining over from previous working by animal power has been greatly enlarged and increased, a total amount of a quarter of a million sterling having gone into the construction of buildings and provision of plant, tools, etc.

Power for operating the tramways is obtained from three stations, situated at St. Denis, Vitry-sur-Seine, and Billancourt. At the first-named it is generated at a pressure of 10,000 volts, and at the others at a pressure of 13,500 volts ; in all cases three-phase. The situation of the power-houses and sub-stations is shown in Fig. 21, there being eight sub-stations, having a total of 23 transforming units with a capacity of 27,300 KW., and with space available for installing other 10 units for a further output of 12,350 KW. The power is transformed in the sub-stations from three-phase alternating at the pressures above-named to

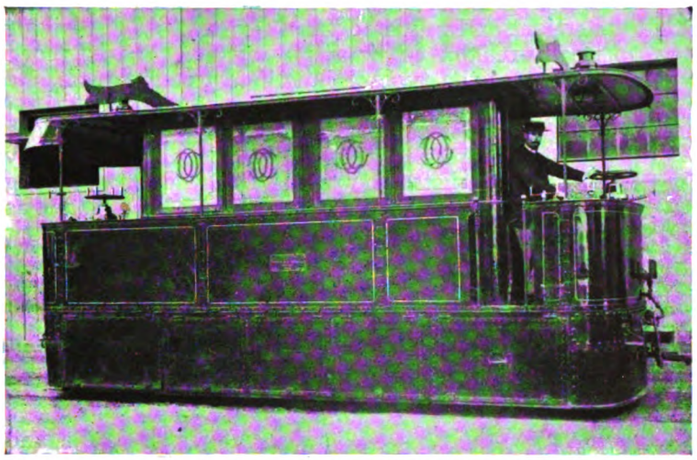

Fig. 12.—Compressed Air Locomotive (1893).

Fig. 13.—Steam Car—Serpollet System (1898).

Fig. 14.—Compressed Air Car with Trailer (1898).

Fig. 15.—Electric Accumulator Car (1898).

Fig. 16.—Steam Motor Car—Purrey System (1898).

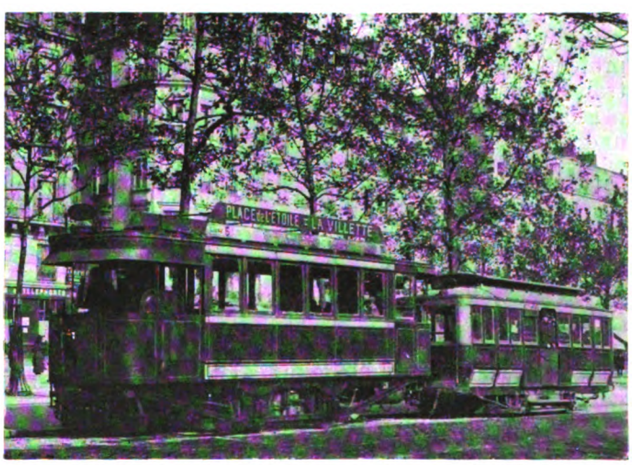

Fig. 17.—Steam Car—Purrey System—with Trailer (1905).

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600 volts continuous for feeding the overhead wires and conduit contact rails.

It will be seen from the plan (Fig. 21) showing the feeders that the high tension mains follow roughly the outline of a triangle with a power-house at each angle. By this arrangement the sub-stations can be fed from the power-house on either side of the triangle, thus ensuring a continuity of supply in case of complete breakdown at any one of the three generating stations—an incident not likely to happen at two of them simultaneously. Automatic transformers or voltage compensators installed at the Dulong and

Fig. 18.—Steam Locomotive and Electric Trolley Car (1906).

Saint Martin sub-stations are used to redress the difference in high tension voltage between current supply from the St. Denis power-house (10,000 volts) and the other two (13,500 volts), when required for feeding from the former, the sub-stations usually supplied by the latter.

The high tension feeders are, as stated, of three-phase design, lead-covered and armoured, the main insulation being, as usual, of specially prepared paper. Those for the working pressure of 10,000 volts have an insulation thickness of 4 mm. round each conductor, and a further thickness of 3 mm. round the triple core thus formed. The circuits for 13,500 volts have these thicknesses increased to 4·5 mm. and 3·5 mm. respectively. The lead cover is separated from the strip armouring by two layers of impregnated paper, one of cotton strip, and a layer of bitumenised hemp; this protection serves to guard the lead covering from electrolytic or chemical action due to the subsoil.

Before being laid down, the high tension feeders underwent severe tests at the works, being called on to withstand without breakdown three times the working pressure between separate conductors, also between conductors and lead covering, for a period of 15 minutes, and twice this pressure under the same conditions for the space of 30 minutes.

After installation, a further test of cables and junctions was made of double the working pressure between conductors, also between conductors and the earthed lead covering, during 30 minutes.

Watertight Junction Boxes.—Design of the Eight Sub-stations.

Particular care has been given to the accessories of the feeder system. The junction boxes are of cast-iron, and are made large enough to hold an inner box of lead in two halves, the ends of which are moulded into sleeve shape for soldering on to the lead covering of the cable. Inside the lead box the conductor ends are joined up in the usual way by clamps, and the box is then filled up with insulating material, the upper half being soldered down to the lower. Great care is then taken to fill up with resin the whole of the interior space of the outer cast-iron box, between its inner walls and the lead box, so that no part of the latter or of the lead cable covering may be put to earth through the outer cast-iron box. The whole joint becomes absolutely watertight and insulated from earth, while also giving perfectly reliable continuity of circuit. Fig. 22 shows a section of the type of junction box employed, and Fig. 23 the method of installation.

The heavy floods in Paris during the year 1910 showed that these junctions could safely be trusted to work perfectly notwithstanding the fact that they were immersed under as much as 20 ft. of water, whilst other junctions of the single box type gave way under similar conditions, putting the cables to earth as soon as it was attempted to pass current through them.

The feeders generally were laid at a depth of about 4 ft. 3 in. in a layer of sand about 4 in. thick. A layer of sand about 6 in. thick was then spread above the cable, and two separate continuous lengths of expanded metal grill between the sand and the ground surface to act as protection and warning in case of future excavation. Under roadways these metal coverings are replaced by cast-iron plates, and where the feeders cross under tramway lines worked on the trolley system and using the rails as return conductors, solid stone covers are employed for a distance of not less than 5 ft. from the track rails to prevent any possibility of return currents traversing the lead covering of the cable.

Where the normal depth of some 4 ft. 3 in. could not be secured, the cable has been carried in cemented brick conduit or covered over with cast-iron plates throughout. At points where the high tension feeders travel in the same direction as the low tensions mains, these protective works are used in common for the two; and at intervals of about five yards enamelled plates

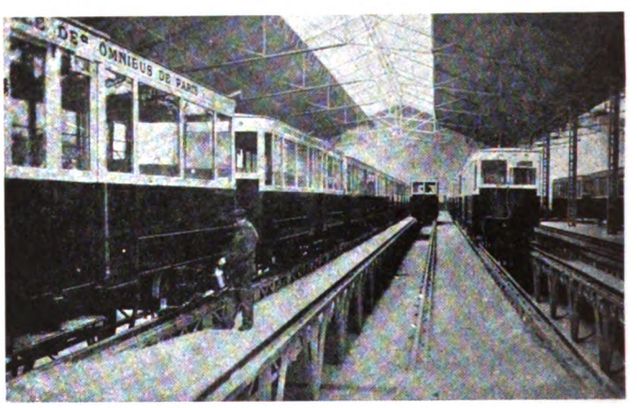

Fig. 19.—Alfort Depot, showing Inspection Pits.

are fixed in the trenches to distinguish between the cables. The bases of these plates are coloured so as to still distinguish the cables even when the plate inscriptions may have disappeared.

The sub-stations of La Nation, Alfort, Point du Jour, and Sèvres are used exclusively for supplying the trolley wire sections of the company's system; those of La Vallee and Dulong give current for the conduit lines only, while the remaining two—Saint Martin and Alma—supply both trolley wire and conduit sections

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at the same time. These stations each comprise, generally speaking, the following parts :—

(*a*) High tension switchboard ;

(*b*) Transformers reducing the alternating voltage to about 380 volts.

tension feeders (between the feeders and the high tension busbars), and also on the transformer circuits between the high tension busbars and the transformers. Two sets of high tension bus bars are provided for current derived from any two power-houses without it being

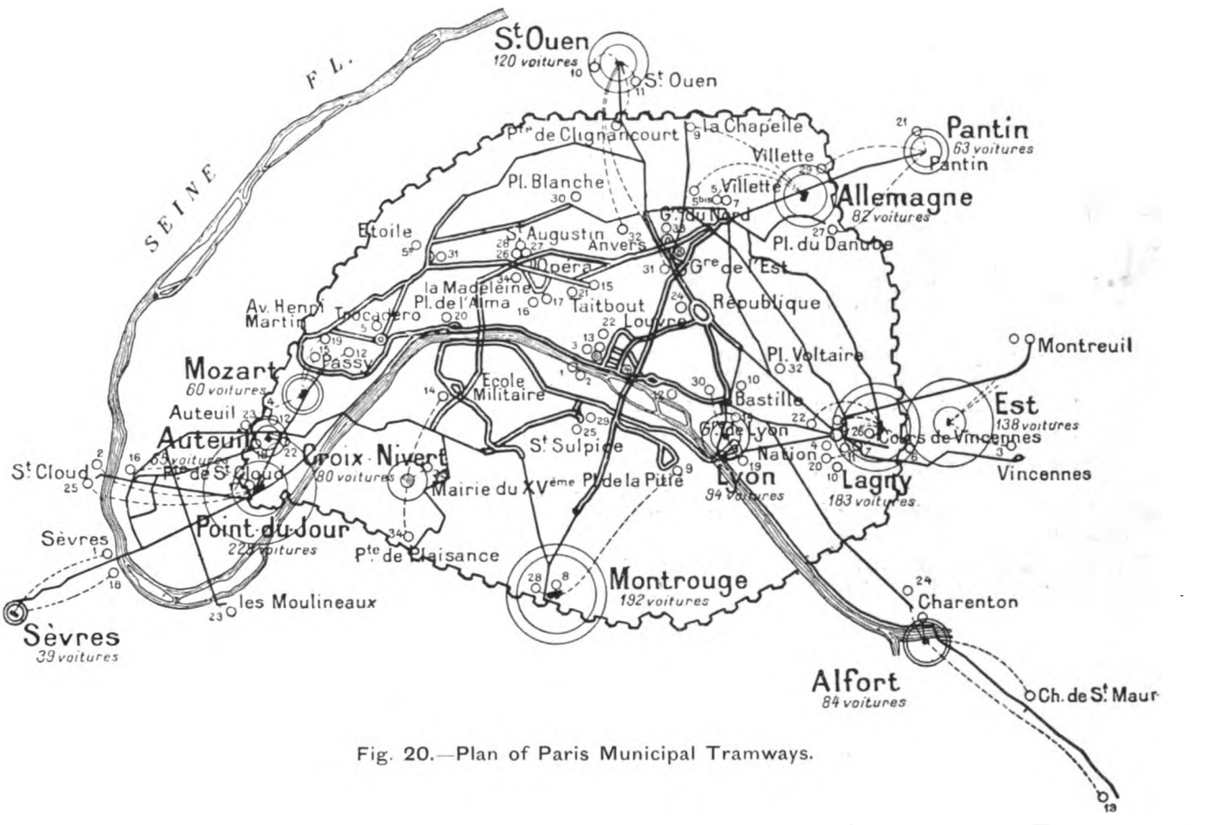

Fig. 20.—Plan of Paris Municipal Tramways.

(*c*) Motor transformers changing the alternating supply into continuous current at 600 volts.

(*d*) Low tension switchboard.

The units installed vary from 500 to 2,000 KW. capacity, but the entire arrangements at all the sub-stations are similar to one another, so that the working

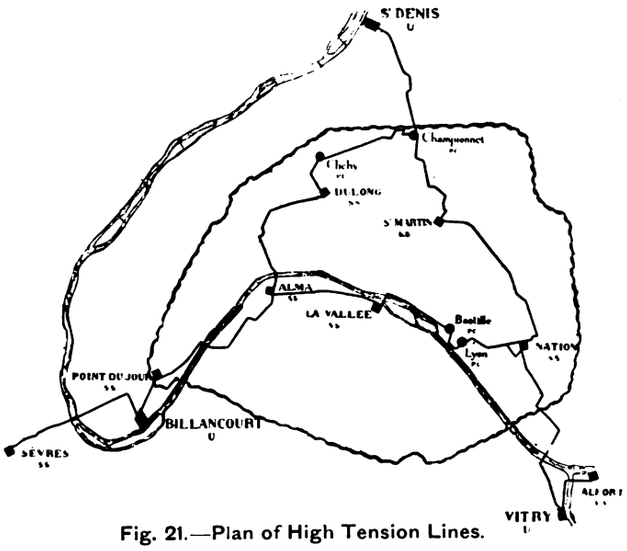

Fig. 21.—Plan of High Tension Lines.

staff has no difficulty in dealing with one or all in the same way.

The high tension switchboard includes oil circuit breakers, which are fixed on the entering ends of the high

necessary to run the power-houses in parallel ; one set is, of course, for normal working, the other for use in case of emergency.

The oil circuit breakers are operated by means of solenoids brought into action by current from a battery of accumulators in the sub-station, and their absolute automatic action is secured by means of ampere meter relays acting oppositely, and fed by transformers on the high tension circuit. The transformers are three-phase on the high tension side and six-phase on the low tension side. The windings are placed in an air-cooled oil bath, electric fans being used for circulating the air round the bath. The secondary winding is made to give, as desired, one-third or two-thirds, or full normal voltage, the connections being taken through a switch panel to alternate terminals of the motor transformers.

The latter are six-phase with plain shunt excitation, non-compounded. They are started up as asynchronous motors, the applied potential being increased progressively as above pointed out.

The low tension switchboard carries the control panels for the oil circuit breakers, both of the alternating current feeders, and the transformers, also the continuous current switch panels of the motor transformers and the feeder panels for the trolley lines and conduit circuits.

The low tension circuits include two separate sets of bus bars, so that the entire sub-station can be split up into two groups, each forming practically a distinct sub-station in itself. This arrangement is of great advantage in the case of mixed supply, that is, to trolley lines as well as conduit circuits at the same

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time, since it allows them, when desired, to be separately fed. In the case of sub-stations serving one system only, this doubling of the main low tension bus bars enables the sub-station units to be separated into two groups, which can be fed by either of the two sets of high tension bus bars from either of two power-houses without putting the continuous current sets into parallel. Of course the low tension switchboard also includes all necessary automatic circuit breakers, switches, ammeters, and other registering and recording instruments of a size suitable to the heavy currents passing.

Aluminium Cables and Conductors for Small Sizes.

Distinct and separate feeders are installed for the trolley lines and for the conduit circuits. For the former positive feeders have been laid to points chosen mainly, of course, for distribution of current at minimum loss, but also with a view to fixing the feeding points as near as possible to the tramway waiting-rooms or sheds placed at numerous points throughout the network of routes, and connected by telephone with the sub-stations and depots. As far as possible, to reduce the cost of laying the feeders, both positive and negative feeders are laid in the same trench. The sections of the various positive feeders were calculated according to Kelvin's law of economic density.

Negative trolley feeders have been laid to such points as were rendered necessary by the technical conditions laid down for working lines that use a return circuit at earth potential; these conditions are embodied in an official decree, dated March 21, 1911, regarding the steps required to be taken in order to prevent the danger of electrolysis to water and gas mains, etc. An extra large number of connections are made between the negative feeders and rails in order to reduce the voltage loss in the rails and the various sections of negative feeders, so calculated that the mean fall of pressure on each feeder (measured during the peak of the daily load) between the feeding point and negative bus bar at the sub-station, should give as far as possible a uniform value. Naturally the limits of such pressure difference between these two points are fixed by applying the law affecting volts loss per mile to the return current in the rails; and to obtain the best results in the case of very short feeders, rheostats, or resistances at the sub-station are used for insertion in the feeder circuits.

Under these conditions it is believed that the average potentials measured between any two points whatever in the area fed from a sub-station, whether between rails or between the rails and neighbouring metallic conductors, such as water or gas pipes, can never reach a value capable of setting up electrolysis. The average fall of pressure on which was based the calculation of the negative feeder sections was taken at 13 to 14 volts, according to the radius of action assigned to the supply from each sub-station.

The conduit circuit feeders have been designed and laid according, generally, to the same principles as in the case of the trolley sections feeders. A notable feature of their arrangement, however, has been that for the most part their outer terminals are led into street junction pillars, in the shape of small kiosks on the footway, or installed in a tramway waiting-room. At these points are fitted polarity reversers controlling the various line sections, so that the setting up of short circuits may be avoided between the conduit contact rails (between which there is the usual potential difference of 600 volts). Should there be at any time insulation breakdowns on the contact rails of opposite polarity, the reversers can immediately be brought into use, and the defective sections put to zero pressure, the negative sections conversely receiving full voltage. This is one reason why the conduit section feeders are kept quite separate and distinct from those for the trolley sections.

The low tension feeder cables are of single core type, lead covered and armoured, and the following standard sizes were decided upon:—300 square mm., 400 square mm., 600 square mm., 800 square mm., and 1,000 square mm.

For the most part aluminium conductors are employed instead of copper in the three smaller sizes, the corresponding sections of aluminium being 510, 680, and 1,020 square mm. From the point of view of cost of conductor material, this substitution of aluminium for copper represented at market rates a saving of at least 30 per cent. for the same ohmic resistance on equal lengths, but owing to the enlarged sections and greater amount of covering required, this economy of 30 per cent. was reduced to 10 per cent. only; still it was enough to justify the use of the cheaper metal.

Furthermore, assuming equal ohmic resistance per mile, the aluminium cable has proved capable of standing at least a 14 per cent. higher limit of current intensity than copper, due to the larger diameter and surface. These cables (which, like the high tension cables, are wrapped between the lead covering and the steel armouring, with impregnated paper strip cotton strip, and asphalted hemp) were tested before

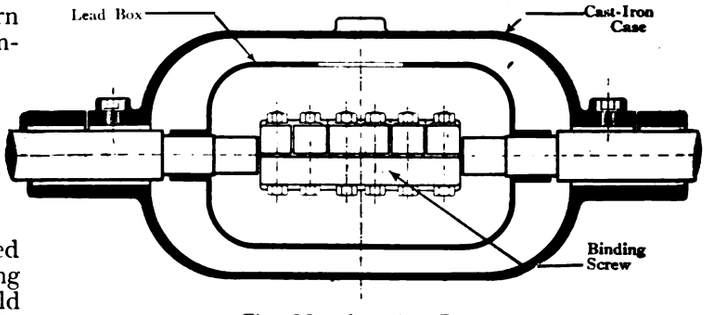

Fig. 22.—Junction Box.

leaving the works with a pressure of 3,000 volts alternating, applied for 30 minutes between core and lead covering; and after installation were again tested at 2,000 volts pressure during the same time.

The total length of trenching used for the low tension cables amounted to over thirty miles, and the length of cable used altogether to about 140 miles, considerably more than half being of aluminium. Speaking generally the method adopted of laying the cables has been much the same for low tension as for high, already dealt with, except that the depth of trench is much less, only about 2 ft. 4 in., with a layer of sand 9 in. thick, and continuous expanded metal covering as a guard and warning in the event of future excavations being made.

Feeders and Auxiliaries.—Trolley Wire Suspension.

Protection against stray currents at points where trolley lines are crossed is even more important with low tension continuous currents than with high tension alternating, and is secured as far as possible by a masonry covering to the trench for some distance on each side of the crossing.

In general the low tension trolley feeders are coupled in pairs of opposite polarity. What are called "reversing boxes," as in the case of the feeders for conduit circuits, are installed at certain points (usually under the street surface) to allow of substituting a

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sound negative cable for a faulty positive one in case of emergency, and these boxes, serving thus for switching over, allow also of the detection and localisation of faults. Junction boxes, properly so-called, are placed at regular intervals where several feeders are laid in the same trench, and serve to connect up in parallel the cables of like polarity. A defective feeder section may thus be cut out while still maintaining supply to the trolley section usually fed by it.

Wherever low tension feeders pass near a tramway waiting-room they are led into it through a connection box provided with reversing switches, cutting out switches, and switches for throwing into parallel similar to those mentioned above. Feeder connections to the trolley wires are made through special boxes fitted on to the street poles, with feeder switches, telephone instrument, and other necessary accessories.

The return feeders are clamp-bonded to the rails, the bonds having a sectional area considerably greater than that of the feeders themselves.

On the conduit sections the paralleling of feeders, which is only occasionally needed in the trolley sections, becomes an absolute necessity. Similar boxes to those employed on the trolley sections are employed for the purpose. Polarity reversers are also installed in the sub-stations on the outgoing feeder terminals. The conduit section feeders are joined up to the rails usually where the conduit is enlarged for the erection of points and crossings, or in special masonry pits designed to secure absolute watertightness for the cable terminal boxes.

For the proper maintenance of the electric service, auxiliary cables forming a telephone network are laid along with the high and low tension feeders throughout. The telephone instruments are all operated by current supplied from batteries of accumulators placed in the sub-stations. Special boxes with terminals for portable instruments are put in at the points where the negative trolley feeders are connected up to the rails, and also in the low tension street boxes, provided, as already explained, with circuit breakers and reversing switches.

The total outlay on the cable and feeder installation generally has been as follows:—

High tension feeder system ..	£100,000
Sub-stations	£156,000
Low tension feeder system ..	£192,000
	£448,000

There is nothing exceptionally noteworthy in the overhead trolley wire construction where this is adopted. Outside the city proper, cross wires are used throughout, either from ordinary side poles or from rosettes on the buildings that front the line of route. Within the city boundaries bracket arm poles are the rule, embodying the standard "City of Paris" design, made uniform for all the companies operating in Paris itself. In both cases the actual poles are the same—apart from ornamentation—each pole being of the usual triple section type. The trolley wires as a rule do not run above the axes of the tracks, but in some cases on the principal thoroughfares or very wide streets are as much as 9 ft., or, in exceptional instances, even 10 ft. distant horizontally from the plane through the track centre.

The wire adopted is of figure 8 pattern, of 67 sq. mm. section inside the city boundaries and 87 sq. mm. outside the walls—with the idea of reducing the loss of pressure as much as possible as well as the need of repairs. Section insulators and overhead crossings are all built up of bronze with insulated bolts, no wood whatever being employed.

At one point of the underground conduit system, where the construction of the lines had to be post-

Fig. 23.—The Making of a Cable Junction Box.—Paris Municipal Tramways.

poned owing to the work of the Metropolitan Railway (Electric Underground) going on in the district, about nine miles of double track, which should have been operated by the conduit method, has had provisionally to be worked with overhead trolley, and cross wires have in this instance been allowed—the only case of the kind in the city. Large section trolley wire is used on this part of the system, meanwhile, in view of the importance and volume of the traffic.

The company's staff have carefully studied and tested in some instances the use of automatic point control, but no great use has yet been made of any of the numerous devices invented for this purpose.

Adoption of Both Side and Central Conduits.

Although no hesitation was felt as to the principle of the conduit system of traction where overhead wires were inadvisable, the exact form or design of conduit and its accessories could not be settled so easily or quickly. The whole question was gone into very carefully, the results being put before a Special Commission, which included two prominent members of the Society of Civil Engineers. That care should be taken to secure the best design is not surprising

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when it is remembered that the outlay upon the conduit system by the company within the city would amount to not less than £1,600,000 for street work alone.

The conditions to be met and satisfied in conduit working may be here briefly summarised. The line insulators must be strong and well able to stand the shocks and blows from the travelling contact ploughs; their insulation must be good, since it must resist a pressure up to 600 volts; their shape must not allow mud or dirt to accumulate on them and lead to short

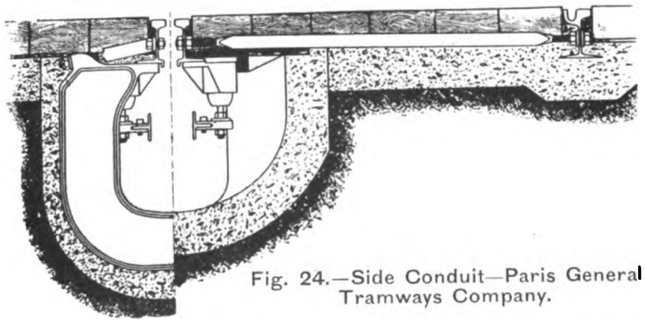

Fig. 24.—Side Conduit—Paris General Tramways Company.

circuits; finally, they must be easily replaceable in case of breakdown or damage from any cause. Then, again, the slot rail must neither be wide enough to give trouble to the ordinary street traffic nor yet so narrow that the plough stem cannot pass freely along. The conduit itself must be strongly built in order to withstand travelling weights above as well as the side thrust of the street causeway. Its depth should be sufficient to prevent any possibility of mud coming into contact with the rails, while also allowing the bottom of the conduit to be cleaned from time to time by sweeping the mud, which inevitably collects along the channel, to mudpits or sumps placed at frequent intervals with sewer connections. It was at one time proposed to construct accessible subways for drainage, inspection, and repairs, but this idea had to be abandoned, not merely on account of the expense, but also from actual want of space underground owing to sewers, gas and water mains, and other public works.

The two great systems of underground conduit are (1) those employing a central slot rail, and (2) those using one of the running rails for the slot rail, which is therefore at the side of each of the tracks instead of in the middle. So far back as 1884, tramways designed according to the first-named method were installed at Blackpool and in Cleveland (Ohio). In 1885 this principle was adopted for some of the New York lines, involving eventually the equipment of

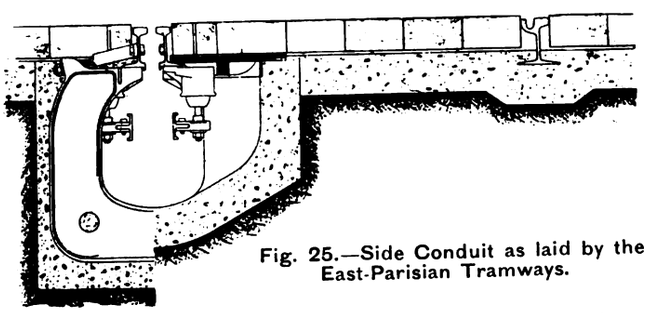

Fig. 25.—Side Conduit as laid by the East-Parisian Tramways.

about 150 miles of track; and in some other American cities conduit tramways previously operated by cable traction were converted to electric working, the original cable conduit (though small and shallow) being adapted for the purpose with more or less success. By 1898 about 12 miles of electric central conduit road had been equipped in Washington, and a small length of double track in Paris, on the Bastille-Charenton route, was also laid down by the Thomson-Houston Company, who continued the experiment of short lengths of such track in other French cities, such as Lyons, Nice, and Bordeaux.

The first side conduit track constructed appears to have been in Boston on a length of about five miles, but it was not further developed in the United States, though in Europe this principle was afterwards extensively employed at Buda Pesth, Berlin, Brussels, in Paris itself, and in Vienna. The prejudice against a side rail conduit in America is shown from a case that occurred in New York, where two companies used a section of track in common. This section was fitted for cable working, and when one of the companies converted to electro conduit working, its engineers preferred to put the conduit and slot rail between the existing central cable conduit and one of the track rails rather than use the latter for the slot rail.

Figs. 24 and 25 show respectively cross sections of the side conduits installed on the tramways of the Paris General Tramways Company, and on the Eastern Paris Tramways Company's lines. Fig. 26 gives a section and part plan of the central conduit chosen by the General Omnibus Company on reconstruction of their lines throughout the greater part of Paris. The decision, in 1903, of the London County Council to

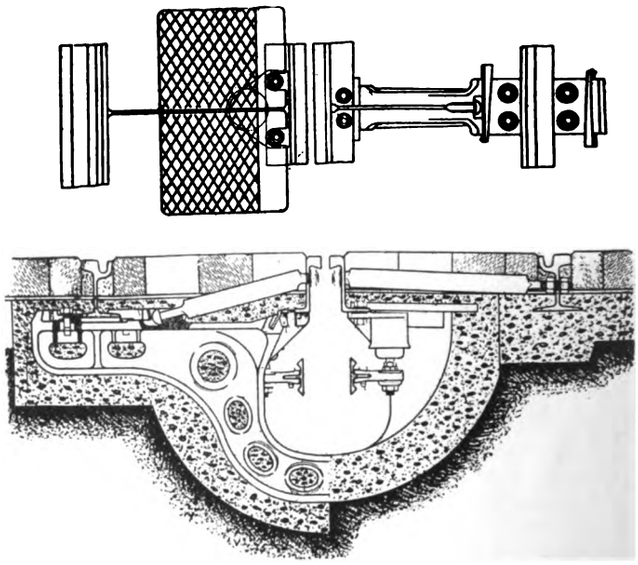

Fig. 26.—Centre Conduit—Paris General Omnibus Company.

electrify the municipal tramway and extensions led to the elaborate inquiry instituted by the Council's staff and experts into the comparative merits of central and of side conduits. The result of the inquiry was the adoption throughout of a central conduit (Fig. 1).

Some particulars of the leading features of the conduit lines above referred to are given in the following table, from which may be noted the differences between the various designs, not, it appears, of great amount or importance:—

	Washington, Central Cond.	General Paris Co., Side Cond.	Eastern Paris Co., Side Cond.	London County Council, Central Cond.	Paris General Omnibus Co., Central Cond.
	Ft. in.	Ft. in.	Ft. in.	Ft.	Ft. in.
Yoke spacing	4 7	3 5½	3 4	4	4 3
Insulator spacing ...	13 9	13 9	13 1½	15	12 9½
Weight of slot rails per yd.	66 lb.	68 lb.	70 lb.	66 lb.	63 lb.
Weight of contact rails per yd.	20 lb.	22 lb.	22 lb.	22 lb.	24½ lb.

(To be continued).

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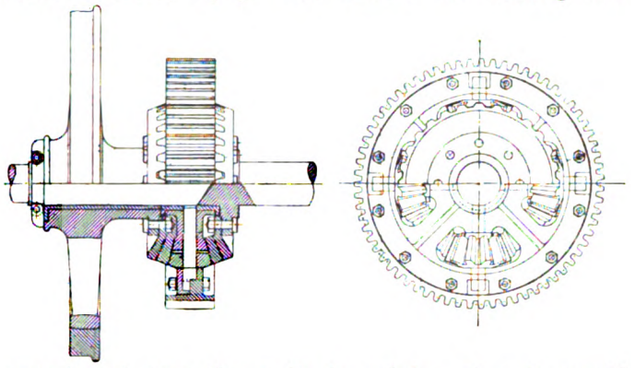
DIFFERENTIAL GEARS AND RAIL CORRUGATION.

By R. H. Wilkinson, A.M.I.C.E.
(General Manager & Engineer, Huddersfield Corporation Tramways).

Having been requested to write an account of the experiment which is being made here with differential gears, I have pleasure in stating that eleven cars fitted with such gears have been in operation on this system since October, 1914. The reason for making this



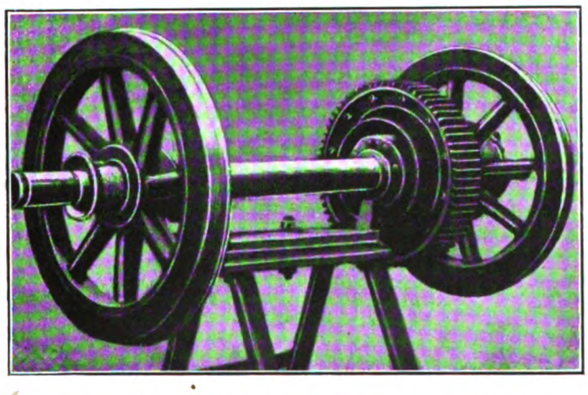
experiment was the writer's opinion that it would prevent the formation of corrugations on the rails. It is doubtful whether sufficient time has elapsed to enable a definite conclusion to be arrived at, so I will give a short account of what has so far been done.

The following alterations are necessary with the car equipment :—

(1) The axles are 6 in. longer, and have a small flange shrunk on to take one of the bevel wheels of the gear to transmit the drive through the axle to one of the car wheels. This also involves the truck being made 6 in. wider. (Otherwise the axle is quite plain with no keyway in it.)

(2) One of the car wheels is loose on the axle, the boss being a few inches longer, bushed and flanged so as to take the other bevel of the gear, thus dividing the drive between the two car wheels.

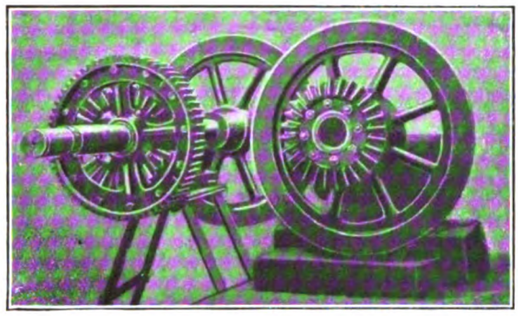
(3) The overall width of the gears being $4\frac{1}{8}$ in. greater than the ordinary type of gear, this necessitates a correspondingly wider gearcase and longer armature shaft and bearing.



These alterations, if allowed for in the design for new rolling stock, do not materially affect the cost. With regard to the differential gear itself, this costs about four times more than the ordinary gear wheel.

The route over which these cars run is six miles long, and the service is every ten minutes, maintained by cars fitted with these gears. Extra journeys are run by ordinary cars for workmen in the evenings, which I believe do not materially affect the experiment.

Previous to introducing these cars, the corrugations were ground out of the rails, and so far they have not reappeared. Outside the question of corrugation, it naturally occurs to one that there should be a reduction in wear and tear of tires and consumption of electricity due to each wheel being free to revolve independently, thus obviating the inherent slipping and skidding that takes place with the ordinary geared car wheels, especially on curves. Also these differential geared cars can coast for a longer distance and the brakes are more effective, but strange to say there is so far no



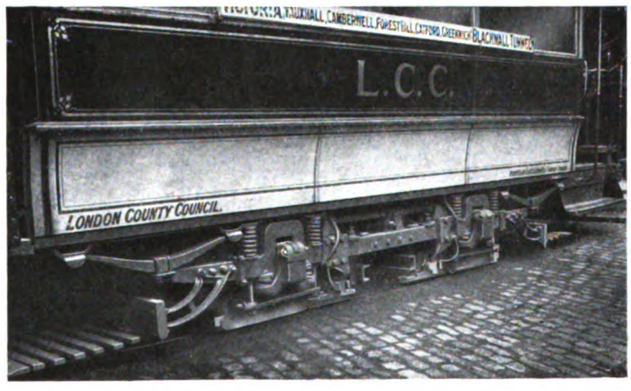
reduction in either tire wear or current consumption, so that the only advantage they appear to possess lies in the prospect of preventing the formation of corrugations.

So far, the wear in the gears is very slight, and no trouble has been experienced with them ; they promise to last many years. The rim of the gear wheel is renewable, leaving the differential portion intact. The method of construction is shown in the accompanying illustrations.

THE SPLASH GUARD FOR TRAMCARS.

The accompanying illustration shows a new type of mud or splash guard fitted to a London County Council tramcar. This form of guard, which is the invention of Mr. A. C. Adams, 6, Reddins Road, Peckham, S.E., is applicable also to automobile road vehicles. The guards on the tramcar have come through a severe test of 30,000 miles running, much of it in very bad weather.

The guard consists essentially of three metal plates. One is a main or longitudinal guard plate supported by brackets or by straps and bolts which engage with the frame or bogie of the vehicle. From this plate there is suspended by adjustable arms and links



a second guard plate which is free to swing in a forward and backward direction, and to move vertically on the outside of the main guard plate. From the swinging plate is adjustably suspended a third guard plate. The connections between the plates are such that the guards can be adjusted to the wheels as the tires wear away. The device also admits of the guard rising over any obstacle on the track. The guards are easily detached when required.

The guard not only prevents splashing, but also acts as a side life-guard on the wheels. Mr. Adams, as well as the Equipment and Engineering Company, 2 and 3, Norfolk Street, Strand, London, will be glad to give further information to inquirers.

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THE
Tramway and Railway World

FOUNDED IN 1892 AND PUBLISHED BY
THE TRAMWAY AND RAILWAY WORLD PUBLISHING COMPANY, LIMITED,
AMBERLEY HOUSE, NORFOLK STREET, LONDON, W.C.

SUBSCRIPTION:

THE TRAMWAY AND RAILWAY WORLD can be obtained, post free, at the following rates:

FOR THE UNITED KINGDOM—Twenty-five Shillings per annum

THE ANNUAL SUBSCRIPTION INCLUDES 64 ISSUES, OF WHICH 12 ARE ILLUSTRATED NUMBERS.

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Single Copies—One Shilling (Postage, 2 pence—Abroad, 5 pence).

THE EDITORIAL AND PUBLISHING OFFICES OF
THE TRAMWAY AND RAILWAY WORLD
ARE AT AMBERLEY HOUSE, NORFOLK STREET,
LONDON, W.C.

Telegraphic Address: "TRAMIGRO, LONDON."
Telephone No.: GERRARD *2948.*

LONDON, MAY 11, 1916.

Municipal Tramway Receipts.

The full effect of the war on the net revenue of tramways in this country as a whole has until recently remained a somewhat dubious point. The accounts of the undertakings whose financial year ended on December 31, 1915, cover, of course, a full year of war conditions, and many of them have come out of the ordeal wonderfully well. Most of the big tramway systems are, however, owned by local authorities whose financial year ends on March 31, and the year which ended on that date in 1915 covered only eight months of the war. During that period the conditions were not so stringent as they have been since. The increase in prices has been more marked during the year just ended, the scarcity of employees has become emphasised, and changes in the volume of traffic arising from conditions created by the war have had full time to make themselves felt. The question of traffic receipts in such circumstances is therefore of much interest. In order to get a proper idea on that subject, it is necessary to make a comparison with the year ended March, 1914, during which normal peace conditions prevailed. A comparison of the returns shows on the whole very reassuring results. In the cases of practically all the larger municipal undertakings the figures show substantial increases. In the districts where munition work is carried on the increases are in some cases very large. To take one or two examples, Birmingham, Bradford, Leeds, and Manchester come out very well, while in Glasgow, Newcastle, and Sheffield the increases are enormous. Leeds, Manchester and Belfast have recently published figures showing the working expenses. In the case of Leeds these are somewhat higher as compared with two years ago, but the increase is not nearly so great as that of the receipts, so that the net revenue is substantially higher. Manchester shows an actual decrease in working expenses, and the net revenue is correspondingly increased. The London County Council returns give about the same receipts as two years ago, but the period includes the time of the disastrous tramway strike in which so much money was lost. A large number of towns record traffic receipts aggregating for the year about the same as those at the end of March, 1914, and this is so in places which can hardly be called manufacturing. Only in a small minority of cases does there seem to be any material falling off as compared with the twelve months ended March, 1914. Some revenue must, of course, have been obtained from troops in training, but on the other hand, for a time at least soldiers were in many places carried free. On the revenue side therefore there is, taking the systems as a whole, ground for encouragement. As to working expenses, we must in many cases wait until the annual accounts are issued, but present indications encourage a hopeful outlook. Coal and all supplies are very dear, wages with war bonuses are high, difficulties of all sorts which cost money have had to be overcome. On the other hand, economies have been practised wherever possible, and no doubt track renewals and other expensive maintenance works have had to be postponed. Net results may accordingly be fairly favourable, and they will certainly be more favourable than might have been expected. It behoves the local authorities, which are so fortunate as to have surpluses, to conserve these with the utmost care, because when peace is restored much postponed repair and renewal work will have to be taken in hand. When that time may

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come no one can determine. Future conditions must for some time remain obscure ; and there never was a period when a careful and conservative financial policy was more required.

To Accelerate Loading.

A general manager has sent to us some comments upon a paragraph in a recent issue dealing with the regulation instituted at Bradford for the formation of queues at busy places, and also with the use of the near side of the front platform as a means of exit. Our correspondent expresses the fear that the queue system "can only minimise the difficulty to a limited extent, as there are busy points where it would be impracticable to attempt the formation of a queue." Although this remark is made by a manager of much experience, we would point out that many difficulties are wont to disappear in the face of a determined effort. As a case in point we would refer to what has been accomplished for half a dozen years past at Southwark Bridge, where the outward traffic in the evening is very heavy. Not one but several queues have been established, and this was done before the London County Council obtained legislative powers to enforce the order of the tramway department. These queues are worked without the erection of permanent barriers, the only structure being a few iron posts parallel with the kerb at the stopping places, and into those posts chains are threaded before the rush. Our critic agrees with the suggestion that to overcome the general difficulty of slowness of loading caused largely by departing passengers being required to "use the rear platform," an alteration is required in the design of the car of the future. In referring to the fact that certain undertakings are dealing with the matter by the use of an exit on the front platform, the correspondent observes that the plan has "some serious drawbacks, which managers must carefully consider before adopting it, viz., the greater possibility of the loss of fares by passengers being allowed to leave without having to pass the conductor, and, further, the greater liability to accident." No such grounds for criticism have been discovered in the use of those of the Huddersfield cars that have been specially constructed for exit at the fore end. Under the existing system of a rear exit a number of passengers do leave without payment while the conductor is on the top deck. With a reversal of the procedure they could be required to hand their tickets to the motorman, which would be an advantage in these days of restricted pulp imports. As to the alleged greater liability to accident, that could only arise from a division of responsibility for starting the car. That work must still remain with the conductor only, but as all passengers would alight under the eyes of the motorman one of the most fruitful sources of mishap would be done away with. These criticisms are not supported by the experience gained in the working of the single-deck cars that were recently converted to front exit operation for very heavy traffic at Newcastle, which were described and illustrated in our issue of April 13. Indeed, the innovation has proved so successful that Mr. Hatton has prepared plans for the conversion of double-deck cars to this principle of unloading. The front exit, however, is not the only method of securing rapid loading. Our issue of November 14, 1912, contained a description and illustrations of a car of novel design by which the general manager at Liverpool had overcome these drawbacks. This design gives a separate entrance and exit on the conductor's platform. Its working has been so successful that this type has been adopted as the standard car, and about fifty of such cars are now in use.

Omnibuses and the Local Veto.

The motor omnibus industry is faced with a formidable and subtle difficulty. Under Clause 20 of the Local Government (Emergency Powers) Bill, accepted by the House of Commons, the consent of the highway authority must be obtained for an omnibus service on any route where these vehicles have not been running regularly within two years of March 1, 1916. The effect of this clause is to apply the principle of the tramway veto to all new services. Anyone who has had experience of that veto will regard its extension with the utmost gravity. Neither the fact that there is an appeal to the Local Government Board (in cases where the consent of the highway authority is unreasonably withheld), nor the circumstance that the Bill is a war measure, will materially diminish the sense of gravity. The corresponding right

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of appeal to the Board of Trade in connection with tramways and electricity supply has proved to be a dead letter. As for the temporary character of the Bill, there is no such thing in English legislation as a temporary precedent. Clause 20 does establish a precedent, and on the very matter in regard to which local authorities have been anxious to get control of motor omnibus services. Apart from the fact that the final clause of the Bill confers upon the Local Government Board the right to continue Clause 20 and other clauses for any period after the war, it is morally certain that the municipal influences which succeeded in getting Clause 20 inserted will not permit it to be dropped. Rather will they work to secure a similar veto over the continuance of services on existing routes. Therefore it would be folly of the most optimistic kind to regard this clause as merely an evanescent provision to protect highway authorities from incurring unnecessary expense during war time through wear and tear of roads due to omnibus extensions. Under present conditions any material development of motor omnibus services must be out of the question. Therefore Clause 20 must be treated as indicating a permanent addition to motor omnibus legislation. It must be regarded as side-tracking all the careful arrangements that have been made for determining the contribution that omnibuses ought to make to the upkeep of the roads they use. Henceforth the highway authorities will determine that contribution in the same ruthless and destructive manner as brought the tramway industry to stagnation. The fact that the principle of Clause 20 was not opposed by the London General Omnibus Company shows that the insidious character of the danger is not universally recognised. For the present, of course, the London General Omnibus Company are not seriously affected by the clause. They had carried their service to so high a stage of development before the war that it is practically immune from the effects of the veto as defined by the clause. On the other hand, not even the London General Omnibus Company can be sure of their ability to prevent the wedge from being driven home. Meanwhile the provincial motor omnibus undertakings that have recently been developing their services will find themselves subjected to the full force of municipal direction. The whole business has been sprung upon the industry so suddenly that there has been no opportunity to arrange for safeguards. But if the lesson of the tramway industry counts for anything, the motor omnibus undertakings will decline to grant more than the most reasonable concessions in buying the consent of the highway authorities for new routes. Experience proves that it is better to abandon the business than to load it with burdens that can only be carried if everything goes well. For the rest, the undertakings should use every endeavour to keep the Government to its promise that the question of the proper contributions of omnibuses to road upkeep should be dealt with after the war.

TRADE AFTER THE WAR.

The Indefatigable Mr. Hughes.

The outstanding feature of the past month in connection with trade policy after the war has been the resumption of the virile speeches of Mr. W. M. Hughes, Prime Minister of Australia. Owing to temporary indisposition he had been obliged to cancel his public engagements for a week or two, but in the latter part of the month he was again actively engaged in advocating steps to prevent the German commercial interests from ever again getting a hold in Britain or in any part of the Empire. All classes combine to do him honour. When he was entertained at dinner at the House of Commons by the representatives of British labour, on April 19, he pointed out what the Labour Government in Australia has done to put an end to German trade, and he advocated for the Empire a great national policy to secure not only national safety but the economic and social welfare of the whole body politic. The end, he affirmed, is to be obtained by organisation, and through organisation alone. In the latter days of April Mr. Hughes received from Edinburgh and Glasgow the highest civic and academic distinctions which are in their power to bestow, and in his speeches in these cities he stirred the *ingenium perfervidum Scotorum* to enthusiasm. In Glasgow in particular he insisted on the need for business organisation and for going over Britain with the harrow of resolute purpose until we have turned out by the roots every fibre of German influence that still lingers. He also urged the necessity for this country to prepare so as to be able to undertake the enormous production of wealth which will be required after the war. A suggestion, the value and importance of which will be widely recognised, was made by Lord Provost Dunlop, of Glasgow, namely, that Mr. Hughes should if possible remain in this country until the foundations are laid of the new, stronger, and better State to which Mr. Hughes points the way.

The Government Attitude.

A little clearing up of the attitude of the Government was afforded by the publication on April 20 by the Council of the Associated Chambers of Commerce of an official report of the proceedings when the deputation from the Chambers waited earlier in the month on Mr. Bonar Law, Secretary for the Colonies, and Mr. Runciman, President of the Board of Trade.

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The former, while unable, pending the coming International Economic Conference and the possible settlement of a policy between the two political parties in this country and the Governments of the Dominions, to commit the Government to any definite scheme, stated that the question of fostering and safeguarding industries and the institution of tariffs will be considered by the Government from a new standpoint altogether. Three principles, he said, are agreed upon—first, that security is greater than opulence; second, that the way in which the war was brought about and carried on by the Germans will not be forgotten by future generations in this country, and that our people will never allow the Germans to exploit the markets of the Empire as they did before the war; third, that the feeling of solidarity in the Empire will make us approach the subject with a real desire to meet the wishes of the Colonies. The great point is to get agreement. Mr. Runciman also said that "we" (evidently meaning the Government) look on the future entirely from a new aspect. He desired to adopt measures which will make for defence and well-being of our people. On all which it may be said that these are excellent general principles, but everything depends on how they are worked out in practice.

The President of the Board of Trade announced on April 26 the appointment of two more committees to consider the position of certain branches of British trade after the war and to report what steps are desirable to safeguard that position. One Committee is to deal with textile industries and the other with the electrical trades. The latter, whose offices are at 7, Whitehall Gardens, London, has for its members some of the most eminent men in the business, including Sir Charles Parsons (of steam turbine fame), Mr. J. Annan Bryce, chairman of the British Westinghouse Company; Mr. T. O. Callender, of Callender's Cable Company; Mr. James Devonshire, director of a number of electric power and tramway companies; Mr. B. M. Drake, chairman of Drake and Gorham, Limited; and Sir John Snell, the well-known consulting engineer, member of the firm of Preece, Cardew, Snell and Rider, and a past president of the Institution of Electrical Engineers. Truly a strong team; let us hope Government action will back them up.

The "Beama" Activities.

Politicians and economists continue to discuss trade problems in innumerable articles in newspapers and reviews; but here we can only mention a few contributions from those associated with the electrical trades and science. The current issue of the *Beama Journal* contains a number of articles well worthy of perusal, including an editorial putting forward a proposal which is supported from other quarters. It says, dealing with the now time-honoured suggestion that there should be a Ministry of Commerce for the United Kingdom, that a completely representative National Industrial Federation would constitute the most effective Ministry of Commerce. If industrialists and business men organised a Board of Commerce, the Government would appoint members to it to represent certain State departments.

Details are given in the same journal of the publicity campaign of the British Trade Committee of the British Electrical and Allied Manufacturers' Association, the object of which campaign is to impress on the public that the defences of this country and its Allies have been based on the engineering resources of Great Britain, and that the proper utilisation of these resources after the war is the shortest road to the restoration of prosperity. A part of the campaign consists of a six months' lecture tour in which Mr. T. C. Elder is doing yeoman service. At the time of the present writing, his latest reported lecture was one before the North-East Coast Institution of Engineers and Shipbuilders. In this he pointed out that as a result of the war the capacity of British engineering works has been immensely increased. At the end of the war outlets must be found for their products, and this can only be done by the cultivation of the scientific habit and method in the economic system of the country. An association, he urged, is wanted to act as a persistent stimulus, not as a technical debating society. He looked to the manufacturers' associations for a method of pooling the experiences of members and providing the equivalent of a system of auditing for various departments. They should be assisted by a board representative of scientific and technical institutions.

In this and other directions the "Beama" is doing admirable work, and in the same connection those interested might profitably read a thoughtful and suggestive little book, "British Destiny: The Principles of Progress," by Mr. D. N. Dunlop, the secretary of the "Beama." In this there is advocated a federation of all the national forces of capital, labour, science, industry, finance, and agriculture.

Engineering and Scientific Research.

A very useful paper on this subject was presented to the Society of Engineers on May 1 by Dr. J. A. Fleming, Professor of Electrical Engineering, University College, University of London. In this the author points to the vast field for engineering work on the conclusion of the war, and to the need for more men who can do new things. The necessity for a broad and thorough scientific education is insisted on, and various lines are pointed out for practical scientific education of service for engineering and manufacturing. This involves the extension of research work, and the author urges combination among firms for research and the collection of information. The Professor condemns the multiplication of Government-appointed committees, and would prefer to see the work carried out by existing scientific and professional societies. It is essential to guard against the bureaucratisation of science. We need the scientific method of collecting the facts and drawing inferences from them to bear on the commercial problems of obtaining markets. In this connection Professor Fleming recommends perusal of Mr. Elder's addresses and Mr. Dunlop's book, which have been referred to above. Some of the Professor's closing words of wisdom are to this effect:—We have to cut ourselves adrift from all the past, its easy, self-satisfied mediocrity, dislike of trouble, and contempt for knowledge. The first steps in this seem to be a large reform in education, and the second are reforms in our system of party government. The only desirable form of government is an aristocratic one in the true and proper meaning, namely, government by the most efficient and the best. The nation will have that Government when it demands it in sufficient earnest.

So far Professor Fleming. Many of the points put forward by him and others are no doubt ideal and difficult of realisation. But the fact that there is such an uprising of opinion in the country is encouraging. The prolongation and the dubiety of the war, the added experiences of the unscrupulous and abominable character of the enemy, both in war and commerce, can only make this country the more determined to see the thing through, and thereafter to paralyse German trade aggression for ever.

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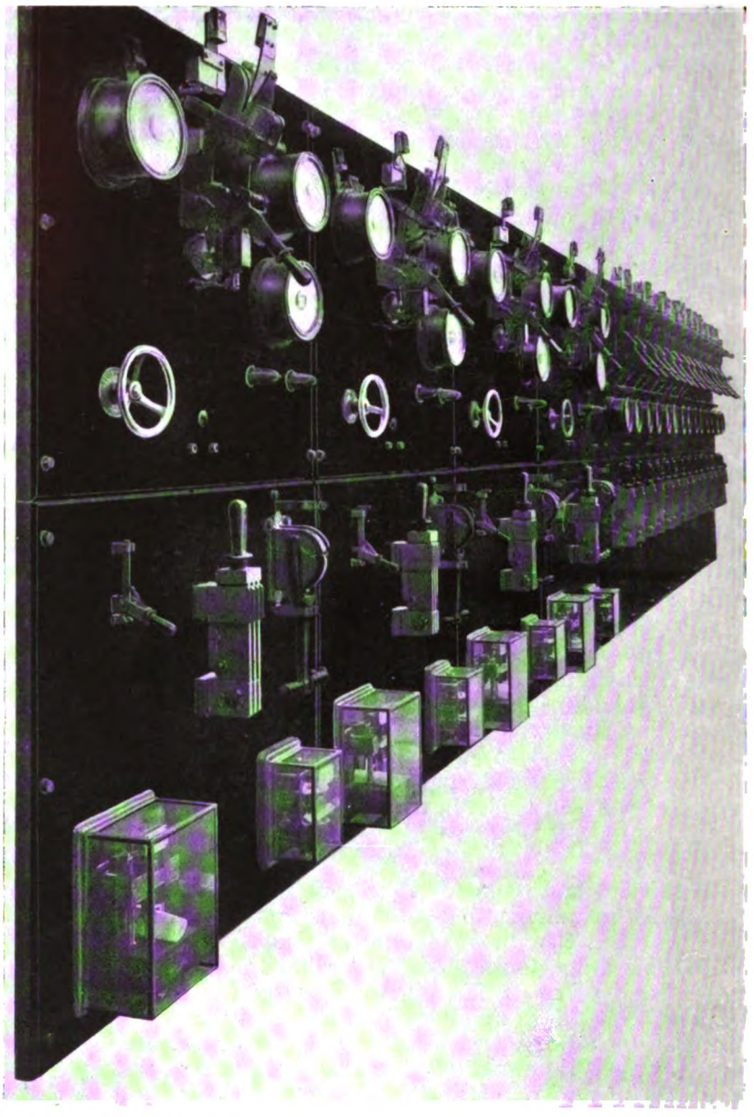
CONTINUOUS AND ALTERNATING CURRENT SWITCHGEAR.

There is probably no branch of electrical work in which the British Thomson-Houston Company have made a greater name for themselves than in the design and construction of switchgear. We are enabled here to produce three excellent views of two boards recently erected, which show clearly many of the features of the most approved forms of construction. In one illustration is indicated clearly the arrangement of the 800-volt remote-controlled D.C. traction switchboards supplied to the Central Argentine Railway Company, Limited, for use in Fernando, Olivos, and Palermo sub-stations. The cast-iron panels are supported on pipe framework, and on these are mounted the operating handles for the circuit breakers and lever switches. The latter are mounted on polished white marble slabs which are installed above the cast-iron operating panels, but sufficiently far back to give free access to the operating mechanism. Special handles are installed on the upper cast-iron panels for tripping the circuit breakers and re-setting the falling weight on the reverse current relays. These devices are actuated by Bowden wire controls. The indicating instruments, which are of the moving coil vertical edgewise type and of the flush pattern, are mounted directly behind the cast-iron panels, suitable windows being provided in front of the instrument scales. The positive busbar is carried at the back of the panels on porcelain insulators bolted to the pipe supports, whilst the negative busbar, together with the equaliser bar, are mounted on insulator supports secured to the rotary converter foundations.

The adjacent view illustrates one of the sub-station switchboards as supplied to the L. & S.W. Railway. The first four panels control the rotary converters. These panels, it will be noticed, have both the D.C. and A.C. control mounted together with the D.C. circuit breakers at the top of the panel and the A.C. oil switch operating handle on the right of the lower panel. The remaining panels are the track feeder panels. The third picture is a back view of the above panels with the heavy busbar work. The first four panels are also in this case for the rotary converters. Although not shown on the photograph, the connections of the rotary converters pass downwards from the panels. The switchboard shown is installed at the Waterloo sub-station, and the following items may be of interest :—

The total number of sub-stations on the system is nine. The switchboards have been in service approximately five months. The system is 11,000 volts 3-phase 25 cycles transformed down by means of transformers and rotary converters to 600 volts D.C. The actual rotary converters controlled by the switchgear in question consist of four 1,500-KW. machines. The British Thomson-Houston Company, Limited, have supplied to the L. & S.W. Railway fifteen 1,500 KW. and eight 1,200 KW. rotaries. A fully illustrated description of the installation of the latter company was given in our issue of November 18, 1915.



600-Volt Traction Switchboard—London and South Western Railway.

BRADFORD NOVEL GOODS CAR.

Owing to the shortage of team labour and carting facilities in Bradford, Mr. C. J. Spencer, general manager of the Corporation Tramways, has recently given renewed study to the question of utilising the tramways for the conveyance of goods. He has now obtained the sanction of the tramways committee and the Board of Trade to experiment with a combined battery and railless trolley car, the accumulators deriving their energy from the overhead wires. The battery method of traction will enable the driver to bring a load from a railway station or warehouse to the nearest tramway track and then utilise the trolley arm for travelling to any part of the city served by the tramways, the final stage of a journey being made if necessary by reverting to battery propulsion. The vehicle would run as a railless trolley car at about the same speed as a tramcar, and it could be worked without interference with the passenger traffic. It is said that the new car of the Bradford Tramways Department will accomplish the work of ten horses and carts at considerably less cost. An added advantage is that the nature of the haulage is of the kind in which a battery vehicle excels.

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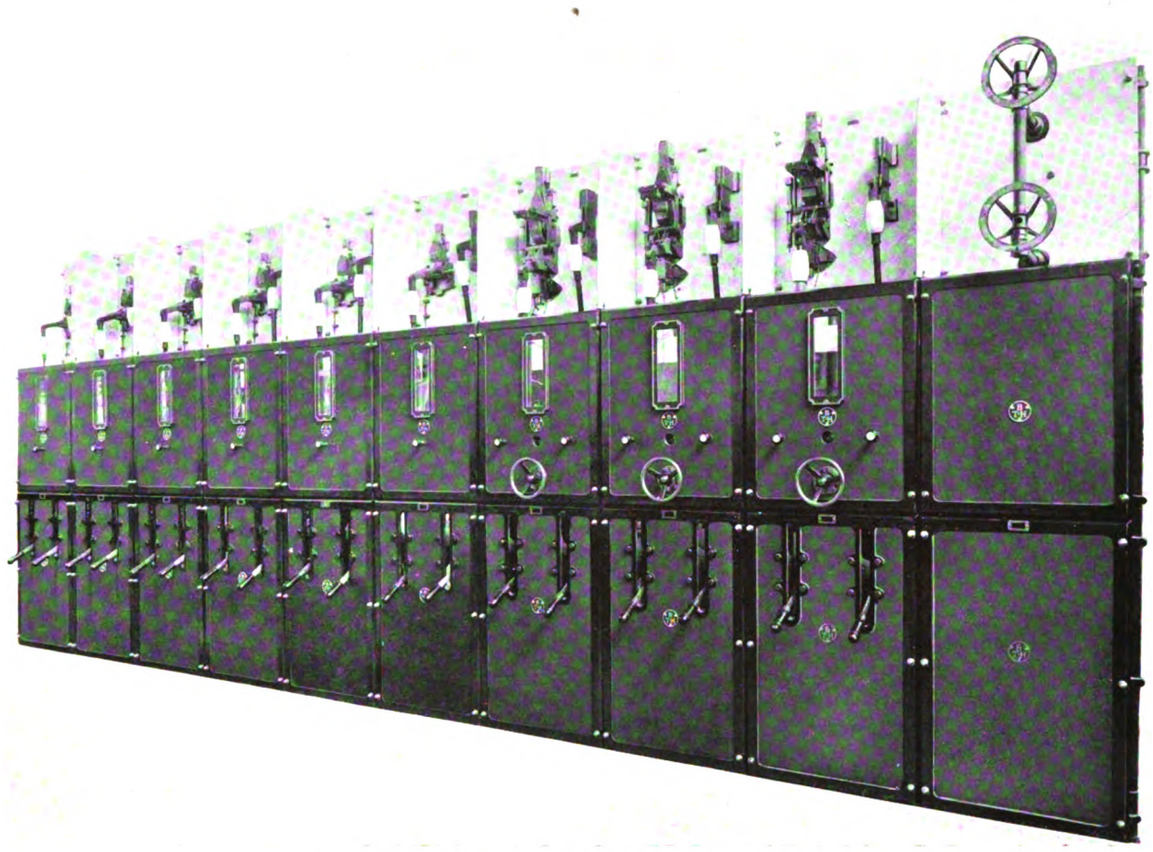
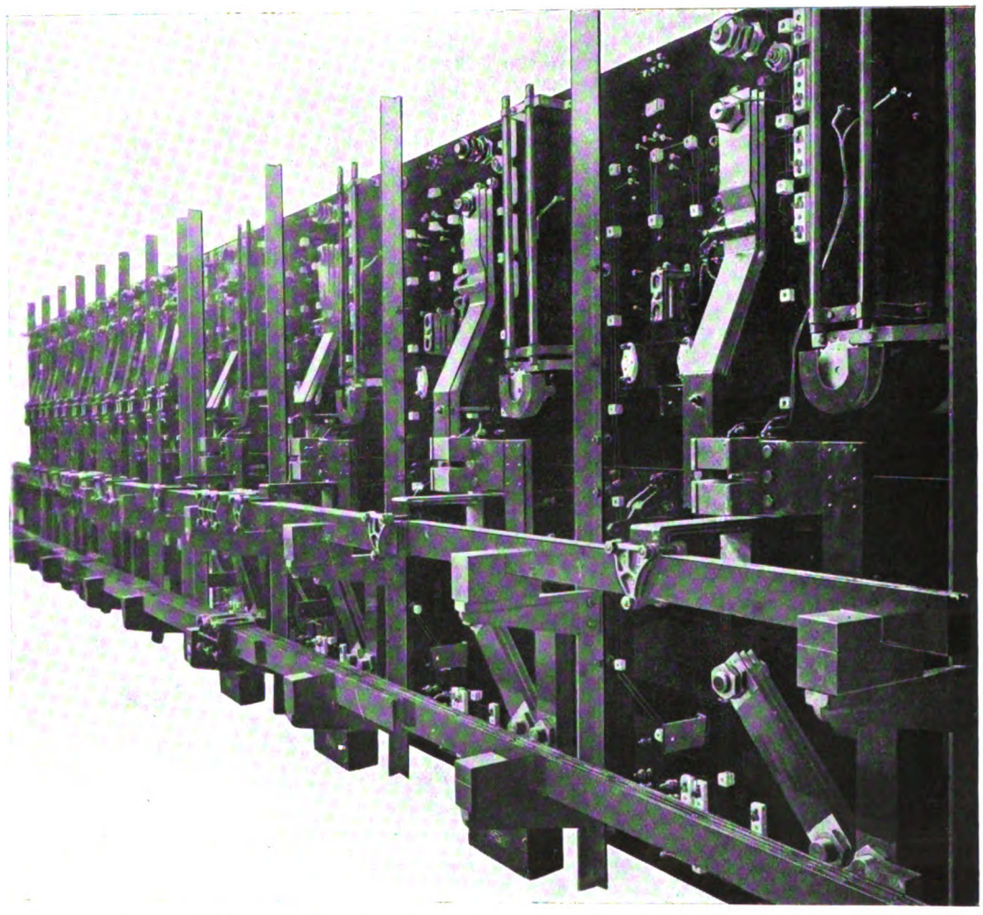


800-Volt D.C. Control Board—Central Argentine Railway.



Back View of 600-Volt Traction Switchboard—London and South Western Railway.

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STRIKE IN THE CROYDON DISTRICT.

On the plea that the South Metropolitan Tramways Company were about to introduce women as drivers, the employees of that company left their work on April 7. According to the president of the London and Provincial Vehicle Workers' Union, the chief reason of the strike was the refusal of the company to submit the men's grievances as to pay and conditions of labour to arbitration. Two women were taken out on the cars on April 6 for preliminary instruction in driving, at the request of the Board of Trade, in order that a report might be made on their fitness or otherwise for the occupation of driving, in view of the shortage of men. On April 11 the strike spread to a number of the employees of the Croydon Corporation Tramways, but Mr. T. B. Goodyer, with the aid of a minority of loyal men, together with the clerks and several members of the Corporation, maintained a fair service of cars, particularly on the route to the London boundary. The chief demand of both sets of strikers was that the pay and conditions should be made equal to those prevailing on the London County Council Tramways. To concede this would entail an outlay of £10,000 by the Croydon authority, to meet which a 2½d. rate would have to be levied. The granting of the concession would also be followed by similar demands from other classes of workmen employed by the Council. These considerations were emphasised at a meeting of the Corporation on April 17, when the Council refused by a large majority to grant the men's request to submit the question to arbitration. On April 25 the Tramways Company assented to the arbitration proposal, and also agreed not to run cars on the Croydon lines so long as the strike in that town continued. The Corporation management proved worthy guardians of the ratepayers' interests, and have provided a service that has improved daily. A number of new men have been secured. On May 4th more than half of the cars were running. A feature of the strike has been the rebuff to the Metropolitan Police by the Croydon Borough, County, and Penge magistrates. At these three courts the police brought a great many summonses against the general managers and temporary motormen and conductors for acting without licenses. All the summonses were dismissed, the county magistrates stating that the company were acting in the interests of the community.

COAL CONSUMPTION FOR LIGHTING.

The appended communication has been forwarded by the Board of Trade to gas and electric lighting undertakings, with a request to inform their consumers that the consumption of coal for lighting purposes must be reduced by 10 per cent. :—

I am directed by the Board of Trade to state that, as you will be aware, difficulies have been experienced for some time in securing adequate supplies of coal for manufacturers of munitions and other consumers of national importance owing to the decline in the output of coal from the mines and the increase in the demand for war purposes. The position has been met in the past to a large extent by a restriction of export, but the coal which is now being exported goes largely to meet the urgent requirements of our Allies or is valuable as a weapon in negotiating with neutral countries.

The Board have observed with some concern the recent decline in coal exports, and in their opinion it has become necessary that special steps should be taken to maintain, and if possible to increase the exportable surplus of coal, and that for this purpose everything possible should be done to encourage economy in the use of fuel at the present time. The question has been further considered by the Central Coal and Coke Supply Committee, and they have recommended that a general policy of economy in lighting should be adopted, and that gas and electric lighting undertakings should be asked to do what they can to reduce consumption by a definite amount.

The Board think there can be little doubt that there are many cases in which light is at present being used needlessly, or wasted altogether. They have accordingly decided to request the owners of gas and electric lighting undertakings that they should notify to their consumers that the Government desires to see the consumption of coal for lighting purposes reduced by 10 per cent., and that they should do all in their power by notices and inspection to see that this recommendation is carried out. The Board would suggest that inspectors should be sent round as often as possible to examine meters, and hand to the consumers where necessary a notice reminding them of the recommendation, and calling attention to the fact that they have not yet carried it out. The Board would be glad to be informed in due course of the steps which are being taken in the matter.

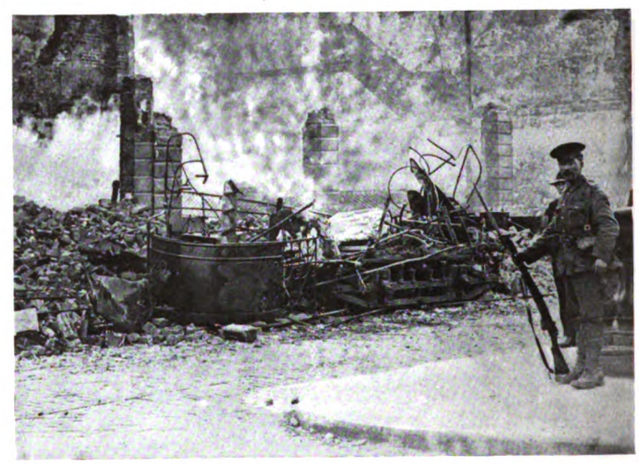
TRAMWAY SUPPLIES AND THE WAR.

With a view to securing a supply of rails during the next twelve months, the special committee of the Tramways and Light Railways Association have asked members to supply the secretary with a statement showing the minimum quantity of rails and fishplates required by them to keep their undertakings in operation. Application will be made to the Ministry of Munitions for permission to have the supplies prepared and delivered. There will be no alteration in the price for steel tires during the present quarter.

The Tramways and Light Railways Association recently made application to the Royal Commission on Paper that licences be granted to paper manufacturers so as to ensure to tramways and other bodies the full amount of their normal requirements in tickets. A reply has been received from the Commission stating that they are unable to licence a greater import on account of tramway tickets than two-thirds of the quantity of pulp imported in 1914. They add that they can see no special call for discrimination, and that there are obvious methods of economising in the production of such tickets. The council of the Association have appointed a committee to deal with the matter further, and in the meantime the council recommend that wherever possible the size of tickets should be curtailed.

DUBLIN REBELS AND THE CITY TRAMWAYS.

As a result of the insensate rebellion of the Sinn Fein organisation in Dublin which broke out on April 24, the services of the Dublin United Tramways Company were at once suspended, and it was not until May 4 that the running of the cars was resumed on some of the routes. On St. Stephen's Green the overhead wires were knocked down on Easter Monday and three cars came to a stop. The vehicles fell into the hands of the rebels, who entrenched themselves and lined the trenches with the cushions from the cars. Partly owing to the destructive tactics of the rebels and partly owing to the military operations for gaining possession of St. Stephen's Green, several cars were badly damaged. The body of one was entirely destroyed, nothing but parts of the truck and some ironwork remaining, as shown in one of our illustrations. Wherever the conspirators and their dupes took up a position, they fired on all traffic,



Remains of a Dublin Tramcar Destroyed in the Rebellion.

and tramcar after tramcar was riddled with bullets and small shot. One body of the rebels seized the power-station, and in numerous places portions of the overhead equipment were destroyed in order to render the tramways useless. The wrecked cars were still at St. Stephen's Green on May 3. One of the signatories of the "Republican Government" was an ex-tramcar motorman.

Some idea of the destruction in Sackville Street may be obtained from a comparison of the accompanying views, both taken from O'Connell Bridge at the end of Sackville Street, the centre of the Dublin tramways.

BRIGHTON OMNIBUS AND RAILLESS TROLLEY POWERS.

On account of the war Brighton Corporation have decided to apply to the Board of Trade for an extension of the time allowed in their Act for the exercise of powers relating to the proposed railless trolley installation, and for the granting of additional powers in regard to motor omnibuses. The railless trolley powers expire in 1917. The motor omnibus clause permits the operation of such vehicles on the authorised trolley routes pending the construction of the railless undertaking. Under an earlier Act of 1903 the Council had also obtained powers to run omnibuses on specified routes, but it has never been exercised. It has now been decided to apply for the amendment of the two Acts in order to acquire a general power of running omnibuses without limitation, in accordance with the present practice in the granting of motor omnibus powers. Authority is also to be sought to enable the Corporation to lease the right to run omnibuses with the consent of the Board of Trade. A similar provision is contained in the Hove Corporation Railless Trolley Act.

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Sackville Street, the Centre of the Dublin Tramways, as it was before the "Rebellion."

[The O'Connell Monument is seen in the centre of the view and the portico of the Post Office is visible on the left. This building was completely gutted by fire.]

A Portion of Sackville Street, as it now appears, Looking North from O'Connell Bridge.

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WOMEN DRIVERS AT GLASGOW.

The accompanying photograph is that of a group of women car drivers on the Glasgow Corporation Tramways. Mr. James Dalrymple, the general manager, informs us that it is now six months since a few women were, as an experiment, first employed as drivers, and to-day the department has 68 actually driving or under training. A few are added to the number every week.

Mr. Dalrymple adds that there is no doubt that the women are doing the work very well indeed; they have far fewer accidents than men, while the general opinion in the city is distinctly favourable. The women take their turn on all the routes exactly as the men do. With the darkening of the streets and country roads that has been instituted since the women took up the driving of cars, their work is now somewhat trying, but in spite of these unusually difficult conditions, they handle the cars very well.

Glasgow Corporation were the first to engage women to discharge the work of conductors when the ranks of the latter were depleted by the men's patriotism in joining the army, and the same enterprise has been shown by the tramways department in training the "motresses," as they are officially termed. Reference to our reports of the proceedings of the Tramways Committee during the past six months show that the male employees have been too patriotic to raise any objection to the second experiment, which Mr. Dalrymple had power to carry out on his own responsibility.

The only opposition came from the local Trades Council, but it met with no sympathy from the Tramways Committee. There are now over 1,200 women conductors, and although the supply of such sturdy women as those depicted in the photograph is limited, the necessity for increasing the number of women drivers is bound to become manifest long before the war ends. Tramway undertakings cannot escape being affected to some extent by the impending institution of compulsory military service for married men up to 41 years of age. The attitude of the Tramways Committee towards the opposition of the Trades Council may be judged from the fact that early in March they authorised the general manager to maintain the tramway service by the employment, if possible, of male drivers, but permitted him, in the event of men not being available, to engage women on the same terms and conditions. Their wages are 29s. per week. At that date Mr. Dalrymple had completed an experiment of nearly four months' duration in the work of women as drivers.

Half a dozen young women, selected from among volunteers from the conductors, were the first pupils to enter the motor school under the direction of Mr. Gardiner, at the beginning of last November. At the end of the month they had completed the term of training which male learners undergo before being placed in charge of a car. Still in their pupilage, they were then installed as drivers in a service run from Coplawhill depot. Their number was gradually increased up to 26, and early in December the original learners were each in sole charge of a car. Soon practically every route had one or more cars driven by women, and by January 31, the number of such drivers had increased to 26. The committee's recommendation was adopted by the City Council, and since then the number of women drivers has steadily grown.

Group of Women Drivers of Glasgow Corporation Tramways.

EDINBURGH CABLE TRAMWAYS.

Edinburgh Corporation have received a report from Mr. A. H. Campbell, the burgh engineer, stating that during a recent month there were 107 stoppages of the tramways. As is well known, the cable system is in use, and latterly the regular running of the cars has been very seriously interfered with, owing to causes that appear to be in dispute. The tramways are owned by the Corporation, but are leased to the Edinburgh and District Tramways, the lease expiring in June, 1919. The question of future arrangements has been receiving the attention of the Town Council, who retained Mr. J. B. Hamilton, general manager, Leeds Corporation Tramways, to report on the subject. In the course of his report, Mr. Hamilton remarks that in view of the purchase of new cars being open to the Corporation, and the life of the cable system being probably limited, his opinion is that they would be justified in paying to the company at the end of the lease £25,000 for the 209 cars and the spare equipment. The directors of the Tramway Company would not accept less than £75,000, and the Committee regarded that as putting an end to their negotiations.

With respect to the present position, the report states that on March 2 an order, signed by the Corporation's engineer, was served on the Tramway Company and Dick, Kerr and Company, Limited—the latter being parties to the lease—requiring them to carry out necessary renewal and repair work within certain specified dates. The Committee intend to follow up these orders, with others, until all the company's obligations have been fulfilled. There are about 48 miles of cable tramway (24 street miles) and one mile of electric line. The former are laid with girder rails weighing 83 lbs. per yard, the latter with 100-lb. rails.

Councillor Harrison, convener of the Tramways Committee, on April 13, submitted to the Council a report on the tramways. The convener, in proposing its adoption, mentioned that the committee had also received from Mr. J. B. Hamilton, of Leeds, estimates of the cost for a complete new service of cable cars, and advice regarding the number of months required to supply these. It was not for the public advantage that these reports should be published at the present time.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls. Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Other.	Total.
Aberdeen	*May 31, 1915	Dec., 1899	E.	27 56	415,000	366,332	48,668	366,332	13,225	184,118	234,194	189,803	86,614	1,388	88,002
Accrington	*Mar. 31, 1915	Aug., 1907	,,	10 53	181,925	144,570	37,355	144,570	13,729	106,831	37,739	16,891	27,510	340	27,850
Ashton-u-Lyne	*Mar. 25, 1915	Aug., 1902	,,	8 15	130,070	111,376	18,694	111,376	13,599	66,708	36,236	3,200	22,577	343	22,920
Ayr	*May 15, 1915	Sept., 1901	,,	9 30	128,000	98,630	29,369	100,705	10,742	78,770	27,866	17,649	17,181	804	17,985
Birmingham	*Mar. 31, 1915	Jan., 1904	,,	118 71	2,858,935	2,437,104	421,831	2,472,938	20,801	1,940,158	496,946	176,726	640,091	6,923	647,014
Blackburn	*Mar. 25, 1916	Mar., 1899	,,	24 69	408,174	342,474	65,700	336,258	13,525	236,534	213,740	6,730	65,466	2,944	68,410
Blackpool	*Mar. 31, 1915	June, 1899	,,	(p)21 51	460,473	316,005	144,468	316,005	14,604	316,005	138,577	19,698	75,344	761	76,105
Bolton	*Mar. 31, 1915	Dec., 1899	,,	47 69	551,092	551,092	Nil	570,981	11,930	348,111	202,980	43,059	140,182	1,228	141,410
Bradford	*Mar. 31, 1915	July, 1898	,,	(h)118 9	1,280,788	1,043,788	237,000	1,043,054	8,831	634,618	439,321	75,208	309,320	20,568	329,888
Brighton	*Mar. 31, 1915	Nov., 1901	,,	17 15	378,093	279,978	98,115	280,392	16,314	211,268	69,124	7,562	54,413	2,113	56,526
Burnley	*Mar. 31, 1915	Dec., 1901	,,	22 18	388,052	326,077	61,975	232,580	10,465	170,852	72,664	29,550	77,161	1,306	78,467
Burton-on-Trent	*Mar. 31, 1915	Aug., 1903	,,	10 50	108,632	104,562	4,070	106,275	10,121	47,788	56,784	10,134	15,223	1,510	16,733
Bury	*Mar. 31, 1915	June, 1903	,,	(b)36 10	407,800	284,745	123,055	293,237	12,826	254,832	55,416	33,960	68,740	276	69,016
Chester	*Mar. 25, 1915	April, 1903	,,	6 35	92,991	82,380	10,611	82,934	12,883	66,977	16,059	5,072	12,935	317	13,252
Chesterfield	Mar. 31, 1914	Dec., 1904	,,	5 8	98,000	73,500	24,500	69,810	13,663	57,660	13,820	6,307	13,608	465	14,073
Colchester	*Mar. 31, 1915	July, 1904	,,	7 75	70,748	69,555	1,193	69,471	8,736	48,360	22,007	Nil.	13,413	380	13,793
Croydon	*Mar. 31, 1915	(q) Sept., 1901	,,	17 50	287,689	287,689	Nil	286,765	16,271	222,223	107,039	41,643	87,833	781	88,614
Darlington	*Mar. 31, 1915	June, 1904	,,	8 71	107,500	77,889	29,611	8,748	77,870	55,236	25,881	7,369	13,451	261	13,712
Darwen	*Mar. 31, 1915	Oct., 1900	,,	7 13	93,400	86,300	7,100	87,199	12,174	51,200	33,555	9,396	14,645	988	15,633
Derby	*Mar. 31, 1915	July, 1904	,,	22 27	...	...	...	248,373	11,113	...	74,267	(r)38,410	51,903	978	52,881
Doncaster	Mar. 31, 1914	June, 1902	,,	12 58	...	...	...	107,921	8,481	94,700	16,581	1,442	22,890	318	23,208
Dundee	*May 15, 1915	July, 1900	,,	28 32	(f)	362,789	...	371,145	13,068	266,027	96,762	92,694	66,320	1,954	68,274
East Ham	*Mar. 31, 1915	June, 1901	,,	14 16	192,270	191,016	254	196,309	13,824	129,336	78,806	...	59,552	680	60,232
Exeter	*Mar. 31, 1915	April, 1905	,,	7 0	106,000	88,818	17,182	88,818	12,688	67,966	21,360	6,420	17,964	55	18,019
Gloucester	*Mar 31, 1915	April, 1904	,,	15 1	191,000	144,333	46,667	147,783	9,846	104,965	22,901	1,000	16,693	1,114	17,807
Halifax	*Mar. 31, 1915	June, 1898	,,	55 39	449,263	417,466	31,797	420,185	7,570	283,249	129,670	36,442	111,792	1,378	113,170
Ilford	*Mar. 31, 1915	Mar., 1903	,,	12 49	152,883	152,883	Nil	149,574	11,859	102,839	50,043	3,239	31,539	442	31,981
Ilkeston	Mar. 31, 1914	May, 1903	,,	3 56	64,214	47,000	17,214	47,833	13,436	31,462	16,422	...	6,915	171	7,086
Ipswich	*Mar. 31, 1915	Nov., 1903	,,	14 70	116,471	114,300	2,171	115,676	7,776	94,894	115,549	15,940	22,796	493	23,289
Keighley	*Mar. 31, 1915	Oct., 1904	,,	6 9	50,934	47,711	3,223	...	...	26,936	20,774	...	8,957	296	9,253
Kilmarnock	*May 15, 1915	Dec., 1904	,,	5 47	65,000	52,795	12,205	52,801	9,450	46,450	10,078	6,618	8,416	201	8,617
Kirkcaldy	*May 15, 1915	Feb., 1903	,,	8 65	213,000	97,868	115,132	97,868	11,105	76,466	21,402	5,223	16,564	412	16,976
Lancaster	*Mar. 31, 1915	Jan., 1903	,,	4 65	...	45,700	...	43,711	9,083	28,750	17,669	3,342	5,534	159	5,693
Leith	*May 15, 1915	Aug., 1905	,,	17 73	275,000	238,000	37,000	237,983	13,286	171,500	66,070	6,604	36,298	1,086	37,384
Leyton	*Mar. 31, 1915	Dec., 1906	,,	8 76	325,084	324,445	639	296,209	16,741	232,345	92,304	2,740	72,983	1,409	74,392
Lincoln	*Mar. 31, 1915	Nov., 1905	S.	2 77	98,519	44,947	53,572	44,987	15,185	40,226	12,529	(l) 692	6,435	117	6,552
Liverpool	Dec. 31, 1914	Nov., 1898	E.	124 0	2,622,786	2,057,850	564,936	2,062,391	16,741	1,168,685	1,177,949	366,545	684,026	13,050	697,076
Lowestoft	Sep. 30, 1914	July, 1903	,,	4 6	96,230	91,178	5,052	91,178	22,375	75,480	17,614	Nil	11,357	373	11,730
Maidstone	*Mar. 31, 1915	July, 1904	,,	7 3	82,932	82,932	Nil	79,398	11,282	63,598	19,334	...	10,402	602	11,004
Manchester	*Mar. 31, 1915	June, 1901	,,	203 31	2,361,038	2,207,215	153,823	2,216,009	10,895	1,648,183	548,499	438,497	887,763	14,112	901,875
Nelson	*Mar. 31, 1915	Feb., 1903	,,	3 69	38,000	37,885	115	37,885	9,808	28,086	9,799	...	9,300	52	9,352
Newport (Mon.)	*Mar. 31, 1915	April, 1903	,,	14 28	232,500	196,250	36,250	196,184	13,671	155,216	49,868	3,479	41,752	952	42,704
Nottingham	*Mar. 31, 1915	Jan., 1901	,,	44 20	...	...	...	733,674	16,586	473,999	261,364	56,626	176,289	3,026	179,315
Oldham	*Mar. 25, 1915	May, 1902	,,	28 32 (b) 8 31	506,723	446,347	60,376	453,655	15,981	303,738	166,268	2,222	111,679	2,135	113,814
Perth	May 15, 1914	Nov., 1913	,,	6 75	90,000	78,350	11,650	78,629	11,334	...	...	...	8,944	928	9,872
Plymouth	Mar. 31, 1914	Sept., 1899	,,	15 0	182,856	181,479	1,377	219,417	14,628	86,903	89,493	24,252	39,989	891	40,880
Pontypridd	*Mar. 31, 1915	Mar., 1905	,,	8 50	137,847	137,839	8	138,568	17,321	107,403	30,436	Nil	22,819	427	23,246
Rawtenstall	*Mar. 31, 1915	May, 1909	,,	15 71	193,290	182,172	11,118	182,276	11,709	150,324	31,848	3,051	24,460	1,076	25,536
Rochdale	*Mar. 31, 1915	May, 1902	,,	(i) 40 2	356,991	347,782	9,209	353,200	15,407	347,782	108,034	16,000	77,660	5,742	83,402
Rotherham	*Mar. 31, 1915	Jan., 1903	,,	12 2	342,200	188,326	153,874	184,178	15,316	150,485	39,473	21,771	43,834	59	43,893
			RT	...	...	...	...	...	...	...	...	...	...	...	...
Salford	*Mar. 31, 1915	Oct., 1901	E.	75 64	1,086,472	723,717	362,755	725,485	9,571	511,853	282,115	30,058	257,935	42	257,977
Southampton	*Mar. 31, 1915	Jan., 1900	,,	18 54	280,452	260,699	19,753	259,834	13,913	158,729	99,470	14,251	68,042	2,996	71,038
Southend-on-Sea	Mar. 31, 1914	July, 1901	,,	7 37	208,400	178,880	29,519	182,577	14,376	156,872	17,055	6,238	47,469	589	48,058
Southport	*Mar. 31, 1915	July, 1900	,,	(d) 10 63	292,000	197,730	94,270	196,178	8,424	67,250	57,870	442	19,970	450	20,420
South Shields	*Mar. 31, 1915	Mar., 1906	,,	10 21	251,882	184,056	67,826	181,097	17,646	155,214	37,314	30,837	39,275	570	39,845
Staly'ge, H., M., D.	*Mar. 31, 1915	May, 1904	,,	27 57	325,270	280,990	44,280	279,778	10,096	209,387	71,603	1,211	37,490	130	37,620
Stockport	*Mar. 31, 1915	Aug., 1901	,,	27 5	318,847	234,500	84,347	265,014	9,789	155,686	92,313	37,776	(a)65,533	1,203	66,736
Sunderland	*Mar. 31, 1915	Aug., 1900	,,	20 28	308,699	303,211	5,488	306,766	15,074	161,996	132,265	45,044	75,229	386	75,615
Swindon	Mar. 31, 1914	Sept., 1904	,,	4 42	...	...	...	44,216	9,771	33,861	11,738	7,237	8,602	309	8,911
Wallasey	*Mar. 31, 1915	Mar., 1902	,,	19 77	208,867	195,290	13,577	222,027	11,122	159,306	72,879	10,612	63,690	815	64,505
Walsall	Dec. 31, 1915	Dec., 1902	,,	19 44	279,007	188,100	90,907	189,814	9,709	148,969	72,319	36,138	39,351	940	40,291
Walthamstow	*Mar. 31, 1915	June, 1905	,,	13 30	198,000	194,000	4,000	190,477	14,251	168,248	25,249	...	41,346	443	41,789
Warrington	*Mar. 31, 1915	April, 1902	,,	9 52	103,674	102,896	778	102,128	10,583	67,028	35,869	7,977	22,631	261	22,892
West Ham	*Mar. 31, 1915	Feb., 1904	,,	30 4	578,478	551,588	26,890	556,878	18,532	469,051	123,888	26,236	147,703	4,509	152,212
West Hartlepool	*Mar. 31, 1915	Feb., 1904	,,	8 63	85,494	80,330	5,164	81,731	9,301	76,501	3,682	4,614	19,011	494	19,505
Wigan	*Mar. 31, 1915	April, 1901	,,	30 73	502,513	491,007	11,506	481,577	15,579	382,490	157,287	5,034	75,270	2,107	77,377
Wolverhampton	*Mar. 31, 1915	April, 1902	S.	21 40	279,733	268,185	11,548	292,361	13,596	209,497	71,812	53,987	54,593	730	55,323
Yarmouth (Gt.)	*Mar. 31, 1915	June, 1902	F.	14 58	149,600	124,750	24,850	126,453	8,588	115,700	29,148	9,613	21,872	494	22,366
York	*Mar. 31, 1915	Jan., 1910	,,	12 20	157,150	...	...	163,884	...	151,039	8,596	6,456	29,589	538	30,127

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	*Mar. 31, 1915	Nov., 1905	E.	98 54	1,528,146	1,381,200	136,946	1,455,506	14,702	1,343,000	257,730	96,622	266,249	3,988	270,237
Bexley	Mar. 31, 1914	Oct., 1903	,,	6 42	100,798	98,812	1,986	98,408	15,376	75,408	23,403	942	14,698	1,649	16,346
Birkenhead	*Mar. 31, 1915	Feb., 1901	,,	24 7	378,973	373,290	5,683	373,545	15,548	228,391	143,241	23,062	65,100	685	65,785
Bournemouth	*Mar. 31, 1915	July, 1902	,,	(e) 32 67	...	...	...	467,073	18,379	291,667	168,818	17,769	101,882	464	102,346
Cardiff	*Mar. 31, 1915	May, 1902	,,	31 66	832,356	787,292	45,064	811,043	25,484	485,049	302,242	98,778	139,256	36,785	176,041
Coventry	*Mar. 31, 1915	Jan., 1912	,,	15 61	251,014	238,355	12,659	238,803	15,151	229,235	14,363	4,095	44,633	771	45,404
Glasgow	*May 31, 1915	Oct., 1898	,,	198 10 (b) 2 53	4,564,266	3,694,143	870,123	3,751,708	19,127	2,411,868	1,282,275	2,326,543	1,070,694	6,184	1,076,878
Huddersfield	*Mar. 31, 1915	Feb., 1901	,,	56 4	772,662	467,142	305,520	477,919	8,526	281,927	194,599	7,522	124,200	2,859	127,059
Hull	*Mar. 31, 1915	July, 1899	,,	33 12	662,074	594,626	67,448	596,092	17,982	579,628	183,392	147,663	161,750	1,280	163,030
Leeds	*Mar. 31, 1915	Aug., 1897	,,	115 71	1,907,865	1,814,758	93,107	1,678,844	14,487	1,400,687	590,421	4,961	429,902	4,038	433,940
Leicester	Dec. 31, 1915	May, 1904	,,	37 76	956,363	867,944	88,419	902,073	23,770	705,985	169,554	92,797	159,678	28,842	188,520
London	*Mar. 31, 1915	...	H.	9 67	...	...	...	...	...	...	...	...	10,261	540	10,801
		May, 1903	C.E	274 35	(c)	(c)	(c)	13,744,806	...	9,836,187	3,786,403	565,095	2,323,130	65,916	2,389,046
N'castle-on-Tyne	*Mar. 31, 1915	Dec., 1901	E.	62 72	1,597,129	1,309,200	287,929	1,332,133	21,178	905,066	524,407	74,656	280,147	13,117	293,264
Northampton	*Mar. 31, 1915	July, 1904	,,	12 37	239,800	147,255	92,545	175,019	13,883	118,932	48,610	14,628	30,775	534	31,309
Portsmouth	*Mar. 31, 1915	Sep., 1901	,,	34 48	708,619	708,619	Nil	731,174	21,132	423,103	285,516	81,715	121,909	2,082	123,991
Preston	Mar. 31, 1914	June, 1904	,,	17 16	224,102	187,269	36,833	187,269	10,888	117,315	47,130	39,392	45,618	328	45,946
Reading	*Mar. 31, 1915	July, 1903	,,	13 14	235,000	234,000	1,000	237,102	17,996	155,419	75,406	19,471	35,608	1,074	36,682
Sheffield	*Mar. 25, 1915	Sep., 1899	,,	79 8	1,782,471	1,484,400	298,071	1,558,246	19,703	1,122,482	512,567	34,450	391,535	2,996	394,531
Wellington, N.Z.	Mar. 31, 1914	...	,,	31 55	496,423	496,423	...	628,151	19,821	496,423	46,836	120,191	157,096	1,161	158,257

C—Electric conduit system. F—Electric trolley system. H—Horse lines RT—Railless trolley system. S—Surface contact system.
(a) Includes £1,441 trackless. (b) Includes leased lines. (c) Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed.
(d) Not including 12 miles 40 chains leased lines. (e) Includes 7 miles 34 chains leased lines. (f) Unlimited. (h) Includes 9 miles 26 chains railless trolley routes.
(i) 17 mi. 8chn. single track leased. (l) Including Insurance. (p) Including leased lines. (q) Corporation working commenced June, 1906. (r) Including £5,711 Accident Reserve.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Working Expenses.					Gross Profit on Working.	Additions to Gross Profit.	Deductions from Gross Profit.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	
Aberdeen	23,291	12,148	7,920	8,166	51,525	36,477	...	4,789	5,179	...	13,840	(i) 1,669	25,477	+ 11,000
Accrington	7,213	(i)2,849	2,116	4,261	16,439	11,411	...	3,997	3,877	358	568	598	9,398	+ 2,013
Ashton-und'r-Lyne	5,215	(i)1,919	2,874	3,470	13,478	9,442	...	2,300	3,965	776	250	...	7,291	+ 2,151
Ayr	4,682	(i)2,301	1,494	2,504	10,981	7,004	...	2,487	2,310	...	...	...	7,004	...
Birmingham	187,946	(i)86,491	86,067	113,375	473,879	173,135	5,558	71,965	58,402	...	...	730	131,097	+ 47,596
Blackburn	17,563	(i)8,497	11,154	9,750	46,964	21,446	479	3,994	15,733	441	1,757	...	21,925	...
Blackpool	17,632	(i 7,755	9,239	10,225	44,851	31,254	...	(h)9,878	7,640	...	...	...	17,518	+ 13,736
Bolton	30,044	(q)9,486	15,912	20,689	76,131	65,279	857	(h)10,525	17,520	1,713	18,339	(i)981	49,078	+ 17,058
Bradford	91,597	(i)36,890	64,670	52,938	246,095	83,793	4,525	22,087	24,164	5,422	7,832	4,203	63,708	+ 24,610
Brighton	14,152	(i)6,759	13,690	8,384	42,985	13,541	55	7,661	5,917	...	...	...	13,578	+ 18
Burnley	21,142	(i)10,079	9,141	17,955	58,317	20,150	...	6,796	8,284	1,515	...	(f)1,890	18,486	+ 1,664
Burton-on-Trent	5,609	(i) 1,821	2,686	3,086	13,202	3,551	24	1,266	1,451	...	...	...	2,717	+ 838
Bury	16,129	4,971	7,162	7,504	35,766	33,250	303	(h) 7,037	6,026	825	2,472	(w)11,193	27,553	+ 6,000
Chester	3,304	(i)1,834	1,318	2,256	8,712	4,540	130	(h)2,748	1,018	..	904	...	4,670	...
Chesterfield	3,214	1,368	2,936	2,192	9,710	4,363	269	2,275	1,900	...	...	...	4,175	+ 457
Colchester	3,045	1,372	2,370	2,783	9,570	4,223	28	(h) 1,986	2,496	...	...	(i) 172	4,654	− 403
Croydon	31,319	(i)9,151	14,128	17,684	72,282	16,332	749	7,889	7,415	1,587	...	...	16,891	+ 190
Darlington	4,273	896	1,895	2,103	9,167	4,545	160	1,926	2,006	101	1,202	...	5,235	− 530
Darwen	4,064	1,146	3,260	2,653	11,123	4,510	222	2,221	2,190	...	1,050	...	5,461	− 729
Derby	18,514	(i) 3,502	6,926	8,941	37,883	14,998	199	6,152	3,568	§ 12	5,432	(i) 141	15,305	− 108
Doncaster	4,969	1,342	6,550	4,166	17,027	6,181	16	2,935	1,840	158	572	58	5,543	+ 654
Dundee	17,829	(i)7,398	7,445	10,686	43,358	24,916	...	8,990	6,700	323	7,842	...	23,855	+ 1,061
East Ham	19,381	6,796	14,558	10,884	51,619	8,613	...	5,279	6,858	...	...	...	12,137	− 3,524
Exeter	4,793	1,535	1,715	3,556	11,599	6,420	...	(h) 2,241	1,950	120	...	...	4,311	+ 2,109
Gloucester	7,250	1,643	2,975	1,836	13,704	4,103	...	(h)5,362	1,881	370	...	...	7,613	− 3,510
Halifax	30,501	7,877	13,529	21,597	73,504	39,321	345	10,424	12,106	...	(y)925	(i)2,632	23,455	+ 16,211
Ilford	10,444	3,518	4,171	5,387	23,520	8,461	557	3,786	5,252	...	...	...	9,038	− 20
Ilkeston	2,262	789	1,378	1,460	5,889	1,197	160	1,450	1,532	90	...	96	3,168	− 1,811
Ipswich	8,801	1,962	5,033	3,494	19,290	3,999	(u) 4,877	(h)3,660	2,207	...	3,421	(i) 237	9,525	− 649
Keighley	3,129	729	1,210	1,676	6,744	2,509	190	935	1,876	...	...	...	2,811	− 112
Kilmarnock	2,995	(i)801	1,434	1,636	6,866	1,751	5	(h)1,863	1,110	...	1,160	...	4,133	− 2,377
Kirkcaldy	4,811	1,416	2,312	2,912	11,451	5,525	68	2,604	2,411	...	409	136	5,560	+ 33
Lancaster	2,207	(i)617	879	1,615	5,318	375	52	942	1,250	...	...	...	2,192	− 1,765
Leith	9,979	3,455	5,148	4,215	22,797	14,587	2,264	(h)6,029	7,850	...	3,252	150	17,281	− 430
Leyton	23,074	10,711	14,202	13,152	61,139	13,253	...	17,968	37	...	...	..	18,005	− 4,752¶
Lincoln	1,446	656	967	872	3,941	2,611	47	1,529	1,071	...	...	(i) 6	2,606	+ 52
Liverpool	192,352	69,830	83,100	123,527	468,809	228,267	25,231	50,082	63,726	...	(d)34,821	(e) 4,869	153,498	+100,000
Lowestoft	3,405	655	1,552	2,323	7,935	3,795	..	2,441	2,251	...	...	...	4,692	− 897
Maidstone	2,584	1,152	2,052	1,771	7,559	3,445	56	2,473	1,976	...	...	...	4,449	− 948
Manchester	273,002	(i)117,573	85,280	128,350	604,205	297,670	14,615	(h)58,243	57,599	13,790	48,584	(e)34,069	212,285	+100,000
Nelson	2,390	798	1,717	1,982	6,887	2,465	...	958	1,059	...	...	314	2,331	+ 134
Newport (Mon.)	10,429	4,234	9,655	6,638	30,956	11,748	857	5,694	4,357	...	1,886	(i) 668	12,605	...
Nottingham	48,272	14,674	17,408	30,692	111,046	68,269	...	16,444	21,121	...	...	(i) 2,040	39,605	+ 28,664
Oldham	27,159	10,158	28,025	19,742	85,084	28,730	1,639	16,158	11,734	2,347	...	(g) 5,799	36,038	− 5,669
Perth	...	...	...	...	6,002	3,870	...	...	...	...	...	...	...	...
Plymouth	8,430	3,896	4,514	8,026	24,866	16,014	1,257	4,282	3,141	690	5,121	...	13,234	+ 4,037
Pontypridd	5,194	1,363	6,831	3,291	16,670	6,575	...	3,761	3,791	...	‖ 665	252	8,469	− 1,859
Rawtenstall	6,126	2,146	3,187	4,273	16,032	9,504	85	5,483	6,493	...	...	...	11,976	− 2,387
Rochdale	19,308	5,063	10,984	11,537	46,892	36,510	1,636	11,478	9,594	2,038	...	(i) (z)10,752	33,862	+ 4,284
Rotherham	E 11,039 RT ...	4,071	5,864	8,718	29,692	14,201	195	5,349	3,465	...	4,082	...	12,896	+ 1,500
Salford	75,579	(i)24,562	27,778	48,819	176,748	81,229	4,477	15,791	668	4,112	492	(k)29,378	51,441	+ 34,265
Southampton	21,466	(i) 6,862	9,433	12,545	50,306	20,732	(t)6,757	7,564	7,557	952	5,000	...	21,073	+ 6,416
Southend-on-Sea	10,109	3,124	6,057	8,656	27,947	20,111	610	(h) 5,604	2,772	...	...	...	8,376	+ 12,346
Southport	4,922	(i)2,406	2,765	3,015	13,108	7,312	6,249	6,549	5,018	...	2,120	...	13,687	− 126
South Shields	9,249	(i)5,225	4,156	6,880	25,510	14,335	140	5,230	3,651	...	...	...	8,881	+ 5,594
Staly'dge, H., M., D.	12,818	(i) 5,022	7,448	5,761	32,049	5,571	...	7,485	7,786	...	400	397	16,068	− 10,497
Stockport	15,630	5,817	10,718	4,683	36,848	29,886	2,260	5,240	10,008	1,586	3,134	2,790	22,758	+ 9,837
Sunderland	19,807	5,608	4,867	11,267	41,549	34,066	265	(h) 6,464	10,374	1,218	10,875	400	29,331	+ 5,000
Swindon	2,854	828	1,534	1,850	7,066	1,845	45	1,215	1,422	...	...	...	2,637	− 747
Wallasey	18,736	(i) 6,704	6,213	10,801	42,454	22,051	1,249	5,520	5,072	...	...	634	11,226	+ 12,074
Walsall	8,744	3,671	4,582	5,958	22,955	17,336	1,279	4,826	4,088	1,000	...	(i) 855	10,769	+ 7,846
Walthamstow	14,417	2,972	8,845	8,546	34,780	7,009	30	(h) 6,427	3,468	...	...	(i) 712	10,607	− 3,568
Warrington	6,135	(i)2,556	2,996	3,323	15,010	7,882	481	2,418	3,447	...	...	...	5,865	+ 2,498
West Ham	52,659	†14,531	33,326	19,420	119,936	32,276	243	18,875	12,679	...	692	...	32,246	+ 273
West Hartlepool	4,791	1,586	2,956	2,241	11,574	7,931	3	2,569	1,847	...	..	(f) 500	4,916	+ 3,018
Wigan	17,340	5,252	12,768	10,817	46,177	31,200	331	(h)13,866	13,101	...	...	3,662	30,629	+ 902
Wolverhampton	13,031	(i) 6,239	8,594	7,202	35,066	20,257	(x) 2,535	7,760	5,669	203	5,416	...	19,048	+ 3,744
Yarmouth (Gt.)	7,397	(i)1,989	2,833	4,441	16,660	5,706	40	(h) 4,158	2,883	...	...	...	7,041	− 1,295
York	9,958	(i)2,908	2,785	6,004	21,655	8,472	...	(h)5,176	2,084	...	...	...	7,260	+ 1,212

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	75,752	17,245	35,294	28,622	156,913	113,325	...	48,342	31,277	1,478	17,879	2,164	101,140	+ 12,185
Bexley	3,282	1,382	*3,554	828	(s) 11,630	4,716	...	2,794	2,509	...	324	...	5,627	− 911
Birkenhead	15,923	(i)5,621	12,124	5,839	39,507	26,278	...	(h)11,340	9,760	527	3,500	151	25,278	+ 1,000
Bournemouth	22,933	7,998	9,095	15,040	55,066	47,280	955	(h)10,587	16,535	...	...	(i)12,166	39,288	+ 8,947
Cardiff	43,914	11,332	26,879	26,593	108,718	67,323	1,123	23,925	22,645	2,272	6,947	2,655	58,444	+ 10,002
Coventry	13,626	4,333	9,005	3,564	30,528	14,876	137	8,521	5,755	...	...	(i)634	14,910	+ 103
Glasgow	345,625	(i)193,837	144,530	51,995	735,987	340,891	65,826	78,797	105,492	22,790	172,310	14,377	393,766	+ 12,951
Huddersfield	33,571	(i)7,911	20,449	12,047	73,978	53,081	...	(h)12,536	13,061	2,274	15,575	1,235	44,681	+ 8,400
Hull	(i)58,137	12,634	31,909	11,622	114,302	48,728	...	16,578	13,883	576	3,117	...	34,154	+ 14,574
Leeds	115,601	40,347	43,609	28,577	228,134	205,805	7,837	47,174	57,773	7,356	11,928	(i)7,844	132,075	+ 81,567
Leicester	58,328	11,980	20,522	31,312	122,142	66,378	355	21,588	21,287	4,484	1,204	(i)7,413	55,976	+ 10,757
London	H. 4,737 E.793,481	1,859 (r) 276,574	3,878 364,064	(m) 5,854 250,124	16,328 1,684,243	def. 5,527 704,803	... 47,425	330,301	405,605	32,102	1,541	(l)15,851	785,400	− 33,172
N'castle-on-Tyne	79,328	25,580	31,120	24,430	160,458	132,806	3,197	(h)29,574	43,356	5,411	68	(i)13,837	92,246	+ 43,757
Northampton	8,428	3,187	3,103	6,136	20,854	10,455	473	(h) 3,900	4,624	441	90	(ib)1,221	10,276	+ 652
Portsmouth	31,414	(i)13,293	8,371	5,580	58,658	65,333	(a)11,483	21,643	18,455	1,941	11,677	532	54,248	+ 22,568
Preston	12,350	4,989	9,252	2,995	29,586	16,360	...	3,625	5,038	...	...	1,356	10,019	+ 6,341
Reading	8,324	(i)4,356	4,313	3,643	20,654	16,028	11	6,709	5,062	263	...	...	12,034	+ 4,005
Sheffield	120,296	(i)31,784	45,385	49,365	246,830	147,701	2,056	31,747	42,504	5,567	30,017	8,014	117,849	+ 31,908
Wellington, N.Z.	57,973	7,775	21,918	17,947	105,613	52,644	2,091	19,865	4,757	...	14,682	...	39,304	+ 15,431

(a) Includes £10,703 balance forward from previous year. (b) Includes £152 loss on omnibus account less profit on parcel service. (c) Includes £1,611 insurance fund. (d) Includes reserve. (e) Includes rents for leased lines. (f) Rent of leased lines. (g) Rent of lines and deficit on motor omnibus account. (h) Including income tax. (i) Includes Army Service Allowance. (j) Includes £692 deficit on railless traction. (k) Includes rents of lines. (l) Including loss on horse traction. (m) Horsing expenses. (n) Transferred to motor omnibus capital account. (o) Includes £1,337 through-running contributions. (p) Includes £407 horse account. (q) Includes National Insurance. (r) Including special charges. (s) Includes £2,584 through-running contributions to L.C.C. (t) Includes balance forward from previous year. (u) From borough fund. (w) Amount apportioned to leased lines. (x) Includes £1,554 profit on motor char-a-banc. (y) Parliamentary Expenses. (z) Includes £6,519 rent of leased lines. * Includes £1,913 spent on renewals. † Under a resolution of the Council, the allowances to employees serving with the Forces, amounting to £6,031, are defrayed out of rates and therefore not included in these accounts. ‡ £2,950 profit from 3 months' working. § Composition for Stamp Duty. ‖ Mortgage Loans. ¶ Included in this amount is £1,912 8s. 0d. paid to men on Active Service.

COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus.			Receipts per Car Mile.		Operating Expenses per Car Mile.					Percentage of Operating Expenses to Total Revenue.	Average Operating Expenses per Car Mile (excludi'g Power Cost).	Board of Trade Units.		
	Carried Forward.	Reserve.	Contribution to Rates or Municip'l Funds.	Average Total per Car Mile. d.	Average Traffic per Car Mile. d.	Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. (Price paid) d.	Total. d.	%	d.	Units.	Cost per Unit. d.	Units used per car mile.
Aberdeen ...	...	7,590	3,410	11·06	10·89	2·93	1·53	·99	1·03	6·48	58·54	5·45	2,317,204	·845	1·027
Accrington ...	...	...	2,013	12·20	12·05	3·16	1·24	·93	1·87	7·20	59	5·33	831,933	1·23	1·51
Ashton-u-Lyne	41	...	2,110	11·529	11·356	2·623	(e) ·965	1·446	1·745	6·779	58·80	5·034	659,302	1·125	1·382
Ayr...	...	...	...	9·61	9·18	2·50	1·25	·79	1·33	5·87	63	4·47	442,969	1·28	·98
Birmingham ...	30,000	17,596	...	10·910	10·793	3·169	1·459	1·451	1·912	7·991	73	6.079	24,186,574	1·125	1·7
Blackburn ...	...	...	...	14·20	13·59	3·64	1·76	2·32	2·02	9·74	68·65	7·72	1,678,976	1·38	1·53
Blackpool ...	...	1,736	12,000	16·82	16·65	3·90	1·71	2·04	2·26	9·91	58·93	7·65	1,552,635	1·58	1·43
Bolton	58	...	17,000	11·758	11·656	2·498	·788	1·323	1·721	6·330	53·836	4·610	4,514,010	1·1	1·56
Bradford... ...	...	14,610	10,000	12·425	11·816	3·457	1·041	2·450	2·027	8·975	74·60	6·948	12,272,121	1	1·926
Brighton ...	18	...	...	12·240	11·782	3·064	1·464	2·964	1·816	9·308	72·79	7·10	1,676,770	1·2	1·51
Burnley	...	...	1,664	11·450	11·259	3·085	1·108	1·334	2·620	8·147	71·16	5·53	3,621,567	1·15	2·20
Burton-on-Trent	838	...	...	9·13	8·30	3·06	·99	1·47	1·68	7·20	78·5	5·28	530,080	1·39	1·04
Bury	...	(k)1,000	5,000	10·26	10·22	2·399	·776	1·253	1·268	5·696	51·82	4·428	2,045,692	1·25	1·26
Chester	...	...	...	9·16	8·94	2·28	1·27	·92	1·56	6·03	66	4·39	414,118	1·33	1·19
Chesterfield ...	...	457	...	11·1	10·8	2·54	1·08	2·31	1·73	7·66	68·9	5·93	420,824	1·25	1·38
Colchester ...	...	...	...	9·942	9·668	2·194	·989	1·709	2·006	6·898	69·24	4·892	445,214	1·5	1·34
Croydon	...	190	...	7·593	7·526	2·683	·784	1·211	1·516	6·194	78·68	4·493	3,000,308	1·416	1·071
Darlington ...	...	...	...	8·487	8·326	2·645	·554	1·172	1·304	5·675	66·85	4·371	504,546	1	1·301
Darwen	...	...	...	14·02	13·13	3·65	1·03	2·93	2·38	9·99	71·15	7·61	485,033	1·312	1·812
Derby	...	...	...	10·233	10·426	3·650	·691	1·365	1·763	7·469	71·6	5·706	1,479,947	1·45	1·216
Doncaster ...	...	654	...	10·52	10·37	2·24	·61	2·97	1·90	7·72	73·1	5·82	799,965	1·25	1·51
Dundee	...	61	1,000	11·802	11·465	3·082	1·278	1·288	1·847	7·495	63·5	5·648	2,564,659	1	1·847
East Ham ...	...	...	...	9·05	8·95	2·91	1·02	2·19	1·63	7·75	85·70	6·12	2,461.677	1·062	1·54
Exeter	...	2,109	...	9·629	9·60	2·560	·821	·917	1·900	6·198	64·37	4·298	615,956	1·375	1·38
Gloucester ...	...	...	...	6·84	6·41	2·78	·63	1·14	·71	5·26	77	4·55	470,336	1	·70
Halifax	...	(r) 7,483	(s)6,171	11·657	11·514	3·141	·812	1·393	2·225	7·571	65	5·35	4,607,293	1·125	1·98
Ilford	...	...	...	8·127	8·006	2·846	·729	1·164	1·109	5·848	73·6	4·60	1,131,616	1·125	1·172
Ilkeston	...	...	...	7·04	6·87	2·3	·8	1·3	1·4	5·8	83	4·4	372,200	1	1·54
Ipswich	...	...	...	8·705	8·52	3·290	·732	1·882	1·306	7·210	82·83	5·904	670,809	1·25	1·045
Keighley	...	...	...	8·962	8·675	3·031	·706	1·172	1·623	6·532	72·88	4·909	277,320	1·45	1·12
Kilmarnock ...	...	...	...	7·413	7·240	2·569	·695	1·235	1·408	5·907	79·6	4·499	314,191	1·25	1·13
Kirkcaldy ...	33	...	...	9·085	8·864	2·574	·758	1·238	1·558	6·128	67·4	4·57	698,804	1	1·558
Lancaster ...	...	...	...	8·10	7·80	3·11	·87	1·242	2·28	7·50	92·57	5·22	227,984	1·7	1·34
Leith	...	...	...	9·26	8·99	2·47	·86	1·27	1·03	5·63	60·98	4·60	984,428	1·027	1·02
Leyton	...	...	...	9·473	9·293	2·939	1·046	1·808	1·675	7·468	78·834	5·793	3,100,748	1·018	1·644
Lincoln	52	...	...	10·59	10·40	2·34	1·06	1·56	1·41	6·37	60·2	4·96	173,895	1·25	1·128
Liverpool ...	...	...	100,000	12·25	12·02	3·380	1·227	1·460	2·171	8·238	65·6	6·067	26,007,694	1·14	1·9
Lowestoft ...	...	...	...	9·1	8·8	2·60	·5	1·2	1·8	6·1	67·64	4·3	318,601	1·75	1·03
Maidstone ...	...	...	...	8·77	8·295	2·04	·90	1·63	1·40	5·97	71·96	4·57	366,191	1·125	1·217
Manchester ...	...	...	100,000	11·300	11·123	3·420	1·473	1·069	1·608	7·570	63·47	5·962	29,922,197	1·029	1·562
Nelson	134	...	...	11·66	11·60	2·98	·99	2·14	2·48	8·59	74	5·11	241,886	2	1·26
Newport (Mon.)...	...	...	...	10·622	10·385	2·594	1·053	2·402	1·651	7·700	72·49	6·049	1,178,500	1·30	1·22
Nottingham ...	...	6,164	22,500	11·35	11·16	3·06	·93	1·10	1·94	7·03	62·78	5·09	5,806,688	1·25	1·53
Oldham	...	...	...	13·351	13·101	3·186	1·191	3·288	2·316	9·981	74·75	7·665	3,158,752	1·5	1·544
Perth	...	...	...	9·39	8·51	3·08	·40	·77	1·46	5·71	60·79	4·25	295,846	1·25	1·17
Plymouth ...	...	...	4,037	12·066	11·450	2·42	1·11	1·29	2·298	7·12	60·83	4·82	1,159,069	1·66	1·38
Pontypridd ...	...	...	...	13·07	12·84	2·92	·76	3·84	1·85	9·37	71·7	7·52	631,981	1·25	1·48
Rawtenstall ...	...	...	...	10·11	9·699	2·40	·99	1·27	1·69	6·35	62·57	4·66	833,714	1·23	1·37
Rochdale	4,284	...	...	11·292	11·134	2·611	·682	1·524	1·654	6·471	56·2	4·817	2,836,062	1·006	1·694
Rotherham ...	E. ... R.T....	...	1,500	12·37	12·37	3·11	1·15	1·65	2·46	8·37	67·65	5·91	1,669,691	1·25	1·96
Salford	...	12,265	22,000	10·623	10·622	3·112	1·011	1·144	2·050	7·317	66	4·972	9,602,534	1·22	1·667
Southampton ...	1,282	...	5,134	...	...	...	...	...	...	...	...	...	...	...	...
Southend-on-Sea	3,346	2,000	7,000	13·8	13·63	2·90	·90	1·74	2·49	8·03	57·4	5·54	1,187,171	1·75	1·42
Southport ...	...	...	...	10·303	10·227	2·483	1·213	1·395	1·521	6·612	63	4·958	465,241	1·5	·977
South Shields ...	...	3,194	2,400	10·308	10·160	2·392	1·352	1·075	1·780	6·599	62·4	4·652	1,200,086	1·353	1·293
Stalybridge, &c.	...	...	...	8·084	8·056	2·755	1·079	1·600	1·453	6·887	83·15	5·269	1,803,063	·9	1·614
Stockport ...	...	250	9,137	10·389	10·322	2·413	·923	1·604	·731	5·671	55	4·940	2,078,189	·512	1·348
Sunderland ...	...	...	5.000	12·210	12·148	3·198	·905	·786	1·820	6·709	54·75	4·8	1,802,694	1·5	1·21
Swindon	...	...	...	9·62	9·24	3·06	·89	1·65	1·99	7·59	79·29	5·60	277,568	1·6	1·24
Wallasey ...	...	4,500	(a) 8,000	12·048	11·896	3·499	1·252	1·160	2·018	7·929	65·8	5·911	1,851,649	1·4	1·44
Walsall	2,372	3,474	2,000	13·217	12·908	2·869	1·204	1·503	1·954	7·530	56·97	5·576	882.078	1·68	1·206
Walthamstow ...	...	...	...	8·75	8·66	3·02	·62	1·85	1·79	7·28	83·23	5·49	1,491,700	1·375	1·3
Warrington ...	2,498	...	...	12·334	12·193	3·305	1·377	1·615	1·790	8·087	64·22	6·208	531,700	1·5	1·193
West Ham ...	...	273	...	9·713	9·427	3·359	1·314	2·127	1·239	8·039	78	6·41	6.306,731	·75	1·66
West Hartlepool	...	3,018	...	9·77	9·52	2·39	·79	1·49	1·13	5·80	59	4·67	680,972	·78	1·42
Wigan	902	...	...	12·415	12·077	2·791	·866	2·052	1·736	7·445	59·70	5·80	2,186,073	1·187	1·461
Wolverhampton	...	...	3,744	11·239	11·091	2·648	1·267	1·746	1·463	7·124	62·5	5·661	1,712,796	1	1·45
Yarmouth (Gt.)...	...	...	...	7·927	7·752	2·618	·704	1·008	1·575	5·905	76·17	4·30	708.756	1·50	1·046
York	...	1,212	...	9·45	9.31	3·11	·92	·88	1·89	6·80	71·87	4·91	...	...	...

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

									*				Works Cost.		
Belfast	...	...	12.185	10·08	9·93	2·83	·64	1·32	1·07	5·86	58·07	4·79	10,439,797	·658	1·39
Bexley	...	..	...	11·13	12·3	2·53	·85	2·82	·68	6·88	71·1	6·20	487,110	·827	1·66
Birkenhead ...	...	1,000	...	13·058	12·922	3·161	1·115	2·406	1·160	7·842	59·99	6·67	2,341,009	·60	1·936
Bournemouth ...	...	8,947	...	13·52	13·46	3·03	1·05	1·20	(b) 1·99	7·27	53·80	5·28	3,072,169	·65	1·69
Cardiff	10,002	...	...	12·354	12·14	3·843	·992	1·358	·835	7·028	59·1	6·193	4,936,582	·475	1·80
Coventry ...	103	...	...	9·902	9·734	2·971	·945	1·964	·778	6·658	67·2	5·88	1,651,950	·502	1·47
Glasgow	...	...	12,951	10·674	10·612	3·426	1·922	1·432	·515	7·295	59·87	6·266	33,848,947	·366	1·40
Huddersfield ...	8,400	...	...	11·05	10·79	2·92	·70	1·78	1·04	6·44	58·22	5·40	5,398,258	·49	1·93
Hull	...	4,574	10,000	8·61	8·53	2·87	·66	1·68	·61	5·82	67·58	5·26	6,352,263	·44	1·40
Leeds	...	...	81,567	10·936	10·834	2·914	1·016	1·099	·720	5·749	52·57	5·029	18,862,847	·668	1·918
Leicester	...	2,757	8,000	11·601	9·827	3·589	·737	1·263	1·927	7·516	65	5·589	7,696,154	·452	1·97
London	...	...	...	E. 9·77 H. 9·51	9·50 9·03	3·24 4·17	1·14 1·64	1·49 3·41	1·02 5·15	6·89 14·37	68·73 151·17	5·69 14·37	152,666,477 ...	·615 ...	2·60 ...
N'castle-on-Tyne	...	25,757	18,000	12·187	11·642	3·297	1·063	1·293	1·015	6·668	53·02	5·653	11,259,266	·382	1·968
Northampton ...	...	652	...	10·89	10·70	2·94	1·10	1·08	2·13	7·25	68	5·12	1,189,423	1·24	1·57
Portsmouth ...	6,568	(i) 6,000	10,000	12·201	11·997	3·092	1·308	·824	·549	5·773	45·88	5·050	3,272,089	·483	1·139
Preston	...	5,041	1,300	10·75	10·54	2·890	1·168	2·164	·700	6·922	64·40	6·222	1,765,250	·407	1·49
Reading	...	1,005	3,000	9·520	9·242	2·165	1·131	1·119	·945	5·360	54·55	4·248	1,180,507	·740	1·15
Sheffield	...	9,032	22.876	10·747	10·666	3·277	·866	1·236	1·345	6·724	61·116	5·379	18,329,775	646	1·979
Wellington, N.Z.	15,431	...	...	16·309	16·189	5·974	·801	2·259	1·850	10·884	65·86	9·034	4,769,149	·906	2·05

* The figures given under "Power" in Table II. include actual works costs only.
(b) Including current supplied by Bournemouth and Poole Supply Company.
(k) Insurance. (r) Renewals Fund. (s) Military Allowances &c. £2,557.
H—Horse lines. E—Electric trolley system. (a)—Debit balance forward £426.
(e) ·161 Army Service allowance. (f) Insurance fund. (i) Including Insurance.
(t) Amounts for 15 months.

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COMPARATIVE ELECTRIC TRAMWAY ACCOUNTS

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Population Served.	Car Mileage.	Passengers Carried.	Traffic Records. Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Popular'n per Annum.	Average Car Miles per Day per Car.	Traffic Revenue per Mile of Single Track. £	Average Traffic Revenue per Annum per Head of Popular'n Served.	Operating Expenses per Passenger. d.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Average Speed per Hour. Miles.	Average Total Car Hours per Day.	Average Number of Cars in Use Daily.	Number of Cars in Stock.
Aberdeen ...	165,000	1,909,009	24,048,816	12·59	·86	145·8	90	3,121	10.6	·514	1·861	·57	7·6	812	63	83
Accrington...	70,000	848,070	4,637,303	8·4	1·424	66·2	105	2,612	7/10	·85	1·07	·929	7·5	240	23	32
Ashton-u-L.	50,000	477,155	4,886,149	10·240	·657	164·84	109	2,757	9/	·392	1·223	·81	8	209	12	25
Ayr	33,000	447,725	4,019,771	8·96	1·02	122	103	1,832	10 5	·65	1·25	·75	8	168	12	22
Birmingham	870,000	14,232,902	149,443,199	10·5	1·03	171·8	86·63	5,384	14 9	·76	...	...	...	...	...	..
Blackburn ...	200,000	1,091,050	12,246,151	11·22	1·20	61·26	105	2,655	6 6	·92	1·25	·76	7·5	434	31	61
Blackpool ...	67,500	1,085,655	13,624,514	12·55	1·32	201·8	103	4,370	22.4	·79	...	...	8	...	29	84
Bolton ...	221,000	2,886,180	31,370,166	10·86	1·066	141·49	124·07	2,920	12/8	·582	1·553	·633	7·25	980	70	112
Bradford ...	370,000	6,194,057	70,077,271	11·31	1·059	189	113	2,807	16 6	·84	1·66	·530	7·3	2,402·5	155	252
Brighton ...	133,936	1,108,352	11,837,828	11	1·10	88·38	76·08	3,165	8/1½	·83	1·27	·787	6·41	512	32	53
Burnley ...	175,000	1,644,712	15,867,699	9·65	1·16	96	120	3,544	8 10	·88	1·25	·83	7	798	42	67
Burton ...	48,000	440,021	3,311,355	7·53	1·06	69	...	1,790	6 4	·95	1·505	·58	7·5	...	...	20
Bury	128,202	1,613,357	15,513,264	9	1·07	121·47	99·73	1,904	10 9	·554	1·30	·77	8·54	...	...	54
Chester ...	39,028	347,318	3,275,944	9·43	·95	83·9	95	2,009	6 5	·64	1·27	·8	7	144·57	10·04	18
Chesterfield	50,000	304,376	2,950,774	9·7	1·1	76	122	2,668	5.5	·78	1·38	·75	7·33	126	7	17
Colchester ...	65,000	332,963	2,434,786	7·31	1·32	37·46	86·80	1,689	4/1	·94	·83	·96	6·77	147·14	10·51	18
Croydon ...	181,956	2,803,883	19,847,402	7·08	1·062	109·08	128	4,983	9 9	·850	2·15	·50	8·23	933·60	60	75
Darlington...	62,383	387,714	4,234,783	10·9	·76	62·15	96·5	1,499	4/4	·52	1·219	·45	6·66	151·25	11	18
Darwen ...	...	267,670	2,741,987	10·24	1·28	...	...	2,045	...	·97	...	...	...	...	...	...
Derby ...	124,000	E 1,217,304	12,414,263	10·20	1·003	100·1	...	2,359	8/4½	·73	1	·775	6·5	...	36	50
Doncaster ...	60,000	529,122	5,747,273	10·86	·955	95·79	93·9	1,798	7/7	·711	1·25	·76	7·5	239	18	32
Dundee ...	165,000	1,388,345	18,753,140	13·50	·851	113	...	2,345	8/-	·544	2	·50	7·3	...	...	72
East Ham ...	145,000	1,596,984	18,916,971	11·84	·75	130	...	4,192	8/2	·65	1·71	·63	...	...	..	...
Exeter ...	48,660	449,103	4,611,444	10·27	·93	95	...	2,566	7/4	·603	...	...	...	...	...	24
Gloucester ...	53,972	624,402	4,358,510	7	·92	81	90·60	1,113	6·2	·75	1·5	·65	7·08	250·8	19	30
Halifax ...	176,000	2,330,104	20,707,071	8·89	1·27	118	81·76	2,015	12·8	·852	1·553	·82	7·23	883·74	78	101
Ilford ...	88,000	945,433	9,203,077	10·48	·78	104·6	...	2,462	7.2	·613	1·543	·69	8	...	..	27
Ilkeston ...	32,000	241,548	1,746,382	7·2	·95	...	90	1,942	52.8	·8	1·50	·5	7	101	7	13
Ipswich ...	76,472	642,092	5,610,332	8·73	·975	73·4	64·4	1,532	6/-	·82	1·53	·693	5·47	322·56	20·16	36
Keighley ...	43,500	247,791	3,552,016	14·3	·68	...	55·2	..	4/1	·45	2·17	·459	...	18	7	12
Kilmarnock	36,000	278,987	2,311,708	8·28	·87	64·2	96·83	1,507	4/8	·712	1·13	·86	7·22	98·03	7·88	14
Kirkcaldy ...	39,600	448,469	5,492,120	12·24	·723	138	49	1,882	8·4	·5	1·522	·64	7	158	17	22
Lancaster ...	41,908	170,337	1,559,037	9·15	·852	37·20	75	1,153	2/8	·812	1·71	·5	8	84·7	6·05	12
Leith ...	110,500	968,808	10,220,069	10·55	·85	92·5	126	2,017	6/7	·53	1·32	·72	8·4	315	21	37
Leyton ...	124,735	1,884,742	19,080,335	10·123	·918	153	121	4,077	11/8½	·769	1·847	·504	8·25	14·6	42·5	60
Lincoln ...	20,000	148,440	1,713,542	11·5	·89	85·67	59·3	2,169	6·5	·552	1·75	·428	7	72	4	8
Liverpool ...	840,000	13,687,888	145,656,374	10·67	1·127	173·40	89·09	5,516	16/3	·772	2·514	·39	7·75	5,040	420	596
Lowestoft ...	35,000	307,838	2,706,348	8	1·07	77·32	70·25	2,787	6/6	·703	1·5	·7	5·75	192	12	19
Maidstone ...	25,000	300,945	2,423,514	8·053	1·03	96·94	82	1,478	8/4	·741	1	1	6·8	128	12	19
Manchester	957,500	19,155,051	202,768,420	10·6	1·06	212	93·5	4,835	18 7	·717	2·514	...	7·75	7·2	561	683
Nelson ...	45,000	192,378	2,484,775	12·92	·85	55·22	87·84	2,407	4.2	·665	1	1	5·5	108	6	11
Newport ...	90,000	964,895	9,410,109	9·75	1·09	104	...	2,909	9/3	·79	1·164	·898	...	...	...	44
Nottingham	264,000	3,789,887	41,210,964	10·87	1·02	156	95·28	3,984	13/4	·646	1·75	·442	6·92	...	109	155
Oldham ...	180,000	2,045,840	22,171,712	10·837	1·19	123·176	...	3,018	12/4	·92	1·13	·863	7	...	...	97
Perth... ...	35,900	252,216	1,844,588	7·31	1·16	51	...	1,289	5/-	·78	...	...	...	...	...	...
Plymouth ...	112,000	838,142	9 333,087	11·13	1·027	83·33	...	2,666	7.2	·639	...	...	...	...	...	42
Pontypridd...	50,000	426,639	5,478,483	12·84	1	121	80·18	2,852	40/-	·73	1·5	·53	6·16	221	17	26
Rawtenstall	40,000	605,485	4,869,792	8·04	1·21	122	111	1,540	12/3	·79	1·121	·88	8·50	247·5	15	24
Rochdale ...	130,000	1,772,546	14,286,607	8·06	1·387	109·90	110·30	2,085	11/11	·78	1·07	·90	7·33	660	44	69
Rotherham...	64,000	E 850,548 RT ...	9,828,838 ...	11·55 ...	1·07 ...	153·6 ...	... ...	3,645 ...	13/1 ...	·72 ...	... ...	... ...	... ...	... ...	... ...	... ...
Salford ...	350,000	5,828,238	54,343,908	9·324	1·134	155	104	3,403	14/9	·78	2·20	·46	7·916	2,065·5	153	200
Southampt'n	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Southend ...	90,000	835,925	10,996,247	13·15	1·03	...	119	3,737	10/6½	·61	1·76	·66	8	18½	24	39
Southport ...	31,312	475,680	4,772,478	10·033	1·004	152·41	100	1,850	12/9	·7	1·6	·7	6·68	225	15	27
So'th Shields	110,600	927,728	10,479,421	11·296	·899	91	126	3,826	7/1	·58	3·1	·38	7·71	285	20	40
Stalybridge	94,091	1,116,936	8,406,915	7·706	1·06	89·3	...	1,353	8/-	·905	1·22	·72	6·8	...	...	60
Stockport	120,000	1,541,700	12,184,055	7·903	1·290	101·5	97·5	2,358	10 11	·726	1 333	·750	7·500	559	43	50(c)
Sunderland	170,000	1,486,201	18,619,364	13·2	·97	109·5	78·3	3,696	8/10	·536	1·34	·68	7	688	43	70
Swindon ...	53,000	223,383	2,392,470	10·71	·859	45·14	75	1,955	3/4	·709	1·2	·85	6	...	...	12
Wallasey ...	87,000	1,284,938	13,555,876	10·54	1·15	153·51	99·2	3,190	14/8	·75	1·89	·54	7	388·53	35·5	67
Walsall ...	100,000	731,640	7,886,190	10·779	1·198	79	95	2,249	7/10	·69	1·24	·79	7	315	21	39
Waith'mst'w	130,000	1,146,743	13,499,838	11·77	·732	103	104	3,089	6/4	·618	1·18	·86	7·6	430	37	38
Warrington	86,000	445,459	6,012,212	13·474	·903	69·91	102·24	2,344	5/3	·59	1·246	·803	6·39	180·99	11·937	21
West Ham	296,570	3,760,361	42,667,561	11·35	·852	144	90	5,041	10/-	·67	1·85	·50	7·66	1,195·75	93	118
W. Hartlep'l	90,000	479,382	4,261,917	8·89	1·07	47	94	2,163	4/3	·65	1·262	·94	7	203	14	26
Wigan ...	200,300	1,495,786	13,811,709	9·23	1·344	69	97·57	2,427	7/6	·802	1·15	·88	7·4	567	42	73
Wolverh'ton	135,000	1,181,309	12,236,785	10·359	1·06	90·64	89	2,539	8/1	·687	1·25	·879	6·85	651·6	36·2	52
Yarmouth ...	56,000	677,153	4,236,424	6·25	1·239	75·65	80	1,500	7/10	·944	1·25	·76	7	310	23	35
York	82,600	762,540	...	...	..	...	...	...	...	...	...	...	...	...	...	..

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast ...	390,000	6,432,600	62,340,269	9·74	1·02	159	128	2,689	13/8	·60	1·96	·43	8·75	2,014	241	290
Bexley ...	16,500	316,970	2,270,070	7·16	1·55	133	126	2,922	19/10	1·24	1·59	·63	9·5	179	11	16
Birkenhead	137,996	1,209,117	14,822,697	12·25	1·052	107·41	73·46	2,702	9/3	·992	1·39	·66	6·84	483·81	45·09	65
Bournem'uth	120,000	1,815,632	16,967,210	9·34	1·44	141	...	3,103	16/11	·78	1·19	·87	6·8	...	...	91
Cardiff ...	182,729	2,742,546	30,424,407	11·09	1·09	166	85	4,358	15/2	·85	1·44	·736	7·5	1,408	88	130
Coventry ...	135,000	1,100,553	8,730,024	7·9	1·22	65	59	2,832	6/7	·84	1·18	·866	6·2	487	41	51
Glasgow ...	1,150,000	24,214,460	336,260,758	13·887	·764	292·4	105·61	5,404	18/7	·488	2·31	·44	8·11	8,974·78	628·20	856
Huddersfield	160,000	(a) 2,797,276	23,933,065	8·69	1·24	159	84	3,556	15/6	·73	1·34	·69	7·72	1,012·16	63·26	106
Hull	291,118	4,551,143	52,087,770	11·44	·745	178·92	123·43	4,879	11/1	·52	2·75	·364	9	1,565·60	97·85	180
Leeds ...	525,000	9,522,737	95,639,268	10·04	1·075	182	115·43	3,747	16/4	(b) ·884	1·93	·539	7·54	3,465	230	345
Leicester ...	232,644	3,899,939	40,440,158	10·369	·947	170	...	4,202	13/8	·72	2·18	·45	8	...	...	160
London ...	...	E 58,706,161 H 272,631	547,253,332 3,244,661	9·32 11·90	1·02 ·76	... ...	117·07 77·12	8,465 1,045	... ...	·73 1·21	... ...	... ...	8·95 5·85	17,972 131·80	1,374 10	1,730 37
Newcastle ...	300,000	5,775,323	65,085,452	11·27	1·073	217	...	4,454	18/8	·592	1·58	·633	...	...	...	223
Northampt'n	91,500	690,177	8,295,941	12·02	·89	90·66	...	2,470	6 8	·603	1·34	·7	...	...	...	33
Portsmouth	246,000	2,438,621	27,554,194	11·299	1·061	112·01	90·29	3,535	9/1	·495	1·66	·62	7	1,065	74	100
Preston ...	120,000	1,025,738	10,340,688	10·08	1·04	86·17	132	2,652	7/7	·764	1·01	·95	7·36	404·7	21·3	33
Reading ...	76,500	924,696	8,881,097	9·6	·96	116	114	2,704	9/4	·54	1·59	·68	7·8	336	25	36
Sheffield ...	485,228	8,810,252	107,023,195	12·147	·878	220	108·86	4,950	16·2	·553	2·917	·371	...	3,215·05	221·728	339
Wellington...	70,000	2,328,849	24,565,376	11·28	1·43	359	85	4,708	44/10	1·031	1·125	·89	7·59	840	75	92

E- Electric trolley system. H—Horse lines. (a) Including 9,467 miles coal haulage. (b) Total expenses per passenger. (c) And 8 trackless cars.

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FINANCIAL REPORTS AND MEETINGS.

Sao Paulo Tramway, Light and Power Company.—A dividend of 2½ per cent. on the issued common stock has been declared.

Rio Tramway, Light and Power Company.—The directors have declared a dividend of 1¼ per cent. on the issued capital stock.

Willans and Robinson, Limited.—The directors announce a dividend of 10 per cent. on the ordinary shares for the past year, carrying forward £8,776.

Falkirk and District Tramways Company.—The report states that the net revenue for the year, including £674 brought forward, was £5,813. A dividend of 6 per cent. has been declared and £726 carried forward.

La Plata Electric Tramways.—The accounts for 1915, including £6,614 brought in and after providing for debenture stock and other interest, show a credit balance of £12,142, which the directors recommend be carried forward.

A Rate in Aid for Heywood.—Last year's working of the Corporation Tramways resulted in a loss of £518, as against a loss of £1,042 the previous year. The Electricity and Tramways Committee, have decided to ask for a rate of 4d. towards the deficiency on the electricity department, and 1d. for the tramways department.

Rochdale Tramways.—The total receipts for the past year were £82,846, an increase of £4,477. The cars have run 1,600,678 miles, a decrease of 88,535 miles. 13,705,871 passengers were carried, an increase of 298,553 on the year. The receipts work out at nearly 12¼d. per car-mile, or more than a penny per mile in excess of the receipts of 1914–15.

Oldham Corporation Tramways.—For the year ended March 31, the net profit on the tramways was £3,985, and the gross profit over £10,000. Out of the latter the department had paid £5,225 in war allowances to employees' dependents, £1,000 for an extension of Hollinwood depot, and £548 for a street improvement. On the three motor omnibuses there was a loss of £720, including a payment of £494 to the sinking fund.

Llanelly and District Lighting and Traction Company.—Mr. A. R. Holland, who presided at the annual meeting, stated that the results so far for the corresponding period of 1915 showed an increase by both tramway and power sections, and he was glad to say the outlook for the future was satisfactory. Resolutions were passed providing for dividends at the rate of 6 per cent. per annum on the cumulative preference shares and 2 per cent. per annum on the ordinary shares carrying forward £673.

Calcutta Tramways Company.—The net profits for 1915, including £7,566 brought forward, were £116,736. A final dividend of 6s. 6d. per share is proposed, making 9½ per cent. for the year, transferring to reserve for depreciation, etc., £15,000, and to staff provident fund £1,309, carrying forward £6,812. The reserve at the commencement of the year stood at £80,550. After deducting therefrom £14,066 written off for renewals, and adding £15,000 proposed to be allocated, it will stand at £81,484.

Depression at Yarmouth.—Last summer the war again brought about a shortage of visitors to the east coast, with the result that the Great Yarmouth Tramways receipts for the year ended March 31 show a decrease of £5,751. The number of passengers was 1,097,760 less, and the decrease in mileage 132,613. The outlook for the present year is also depressing. Early in the morning of April 24 this and the neighbouring port of Lowestoft—both unfortified places—were subjected to bombardment.

Oldham, Ashton and Hyde Electric Tramways.—The report for 1915 states that the revenue amounts to £34,823 (compared with £33,398). The expenditure (including £1,600 for debenture interest and £1,500 placed to renewals account) amounts to £25,062 (compared with £26,024), leaving a net profit of £9,761 (compared with £7,374). Added to £1,021 brought forward, available balance is £10,782. The directors propose to place to reserve fund £3,000, a dividend at the rate of 6 per cent. per annum on the ordinary shares and to carry forward £2,282. The ordinary dividend has been 6 per cent. for 12 years past.

Colonial Companies and Double Income Tax.—As the result of representations made to the Government concerning the hardships entailed by the imposition of double income tax within the Empire, a matter of importance to many tramway companies, the Chancellor of the Exchequer, introducing the recent Budget, said the question would have to be dealt with in the promised reconstitution of our income tax law. For the present, where the Dominions tax was not less than 1s. 6d., he would be content with not imposing any further burden. Persons affected would be entitled to claim repayment of the additional rate now imposed.

Yorkshire (Woollen District) Electric Tramways Company.—The report for 1915 states that revenue amounted to £71,594, being an increase of £6,209. After deducting all expenses chargeable to revenue, including repairs and maintenance, payments to local authorities under agreements, debenture and other interest, and setting aside £5,000 to renewals fund, there remains £13,363, which, added to £2,587 from last account, makes an available balance of £15,949. It is proposed to apply to reserve fund £4,000, to pay a dividend at the rate of 4½ per cent. per annum on the ordinary shares, and to carry forward £2,948.

Cork Electric Tramways and Lighting Company.—The directors' report for 1915 shows that the revenue was £63,905 and the expenses £42,415, leaving £21,490, plus £2,480 brought forward. Interest on debentures requires £4,600, and 5 per cent. preference dividend £6,163. The sum of £6,500 is added to depreciation and renewals reserve, £1,776 is to be written off wiring consumers' premises, £890 written off investments, and £1,041 is to be carried forward. Lighting and power business continues to show satisfactory progress. The number of passengers carried was 5,899,003, as against 5,858,904 in 1914; the car mileage was 870,094, as against 832,227.

Penny Universal Fare at South Shields.—Alderman W. G. Wylie, chairman of South Shields Tramways Committee, has reported that the tramways have now been ten years in existence. The first year's receipts were £24,000, while for the year ended March 31 last the revenue was £42,942, an increase of £1,900 as compared with the previous year. The undertaking had proved a great municipal success. The amount given in relief of the rates last year was £2,400, which was equal to more than a penny rate. Early in 1913–14 the Corporation, as the result of a report presented by Mr. W. T. Robson (who last year became general manager at Southampton) introduced the penny universal fare.

Dublin and Lucan Electric Railway Company.—At the annual meeting Mr. J. W. Hill (chairman) said that the cost of all materials was steadily rising. For the past two years they had been unable to pay any dividend on the preference capital. In order to increase their receipts, the directors had increased both passenger and goods rates. The total receipts were £7,510, the highest the company had experienced. Unfortunately, the cost of working more than counterbalanced the higher receipts. After providing for debenture interest to date, there was an available balance of £528 5s. 7d., which the directors recommended be carried to the next account, postponing the payment of the cumulative preference dividend for the present.

Potteries Electric Traction Company, Limited.—The report for the year ended December 31, 1915, shows that the revenue amounted to £136,167 and the traffic receipts to £119,872, the latter being an increase of £4,789. After deducting all expenses chargeable to revenue, including £11,269 for debenture and other interest, there remains £40,872, an increase of £5,047 as compared with 1914. Adding £1,698 brought forward, there is an available balance for distribution of £42,570, which the directors recommend should be allocated as follows:—Reserve account, £8,036; renewals account, £10,000; dividend on preference shares (5 per cent.), £12,250; dividend on ordinary shares (3 per cent.), £7,350; balance forward, £4,934. The reserve will then stand at £36,824, and the renewals account at £35,738. The receipts from the tramways and omnibus services showed satisfactory increases during the second half of the year, but owing to the shortage of labour, working conditions were exceedingly difficult.

Wallasey Corporation Tramways.—The following comparison of traffic results for the year ended March 31, 1916, with the figures for the previous year, has been issued by Mr. R. B. Greene, the general manager:—

	March 31, 1916.	March 31, 1915.	*Inc. or Dec.*
Traffic receipts	£65,833	£63,697	+ £2,136 or 3·33%
Miles run ...	1,231,461	1,284,939	− 53,478 or 4·16%
Passengers ...	14,306,621 (a)	13,555,876 (b)	+ 750,745 or 5·53%
Receipts per car-mile ...	12·830d.	11·897d.	+ ·933d. or 7·84%
Average fare per passenger ...	1·154d.	1·152d.	·002d.

(a) Including 626,464 military passengers (free of charge).
(b) ,, 286,172 ,, ,, ,,

Bradford Tramways in 1915-16.—Mr. C. J. Spencer, general manager of the Tramways Department, has presented to the Tramways Committee approximate figures relating to the financial year just concluded. The total receipts amounted to £334,315, an increase of £14,921, or 4·7 per cent. The car mileage amounted to 6,199,601, a decrease of 172,109 or 2·75 per cent., compared with the previous year. The decrease was due to a shortage of men and of stock. Notwithstanding the large withdrawal of men who had joined His Majesty's forces the number of passengers—74 millions—exceeded that of the previous year by four millions. There was an increase of 230,000 units in the consumption of electricity, representing roughly a cost of £1,000. The larger number of passengers carried and the heavier loads borne by the reduced number of cars in service account in part for the greater consumption of electricity. The wage bill amounted to £129,313, an increase of £9,182. War bonus totalled £7,102, and allowances to dependents of employees serving in the forces, £7,352. With regard to the expenditure Mr. Spencer states that certain important returns are not yet available.

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Aberdare Tramways and Railless Cars.—Mr. A. J. Abraham, general manager, has presented to the Tramways and Electricity Committee his report for the year ended March 31. As the tramway department has not yet been working two full years, comparisons are not yet possible. The following traffic records cover the operations for 1915 :—

	Car Miles	Passengers	Passengers per car mile.	Revenue per car mile.	Costs per car mile.
Cars	285,200	2,474,309	8·68	11·89d.	6·12d.
Omnibuses	77,182	570,792	7·39	8·71d.	7·48d.

The tramways are 2·7 miles in length, and the gross profit was £6,780. Allowing for interest and loan repayment, there is a net surplus of £4,044, which is equal to 2·52 per cent. on the capital. The railless omnibus system, which is still being worked by the contractors, has a route length of 2·98 miles. The gross profit was £423, and after providing for interest, certain special expenditure and loan repayment, there was a deficit of £574. Up to January 1, 1916, 38 employees, or 40 per cent., had joined the forces.

Brush Electrical Engineering Company.—The net profits for 1915, including £7,065 brought forward, were £24,365 after providing for debenture interest. It is recommended that £8,000 be appropriated for depreciation, and £2,044 in payment of the further 4 per cent. interest to which the holders of the 6 per cent. prior lien participating second debenture stock are entitled out of the first net profits available for dividend in any year, that £5,000 be placed to the reserve, and £9,321 carried forward. Mr. E. Garcke, presiding at the annual meeting on April 18, in moving the adoption of the report, said that despite the many difficulties of the past year they had maintained the improvement of recent years. The gross profits were a little larger, being £61,800, as compared with £60,800 in 1914. But the general charges had been £1,200 higher, and they had spent £1,200 more on maintenance of plant and buildings, so that the net distributable profits for 1915, after paying all debenture interest, were £17,300, compared with £19,100 in 1914. The performance of the Ljungstrom turbine continued to be highly satisfactory. Mr. B. S. Broadhurst (managing director) seconded the motion.

British Westinghouse Company.—Mr. J. Annan Bryce, M.P., presiding at the annual meeting, criticised the excess profits tax, which, he said, made no distinction between profits derived out of the war and profits made from normal business during the war, if the total profits of a company during the war exceed those of the twelve months prior to the war. In the case of the Westinghouse Company, the larger profits of 1914, as compared with previous years, were not due in any sense to the war, but were actually smaller than they would have been had there been no war. Yet the company would be called upon to pay to the Government one-half of the extra profits of that year. With regard to the general business of the company, one order in 1915 amounted to £500,000, and was for the electrification of an important railway. Apart from this, the orders showed an increase over 1914 of some 30 per cent., and a considerable part of this increase was probably due to the absence of German competition from which the company had suffered so much in the past. Taken on the whole, the prospects as regards the company were favourable. Although he entered Parliament as a Free Trader, he advocated that steps should be taken to meet the competition of enemy countries.

London County Council Tramways.—For the year ended March 31 it is anticipated that the accounts will show a deficiency of £64,160, which will have to be met by drawing upon reserves. The general reserve fund stands at about £70,000, but owing to the depreciation in securities this figure may be reduced by £6,000, which will necessitate taking that sum from the renewals reserve. This fund amounts to about a quarter of a million. During the past year the revenue has provided £120,000 in respect of employees' war allowances, £450,000 for debt redemption, and £400,000 for interest. At the meeting of the Council on April 18, Sir George Goldie, chairman of the Finance Committee, introduced the estimates for the financial year 1916–17, and in referring to the tramways deficit deprecated the drawing of conclusions as to the financial prospects of the undertaking from the position under war conditions. They had once more to face a deficiency, although it was not a "loss" in the commercial sense. If the estimated results of this year should be realised, and they had to find a sum of £74,000 to make both ends meet, the reserve fund might barely suffice for the purpose. There would still remain a substantial amount to the credit of the renewals fund, which might be regarded as available, if necessary. Some satisfaction might be derived from the fact that, according to the latest figures, the results of the year were likely to show an improvement on the original estimate—an adverse balance of £91,614 was expected to be reduced to £64,160, notwithstanding the strike of May, 1915, which occasioned a loss estimated at £100,000.

Belfast Corporation Tramways.—Mr. Andrew Nance, general manager, has presented his eleventh annual report to the Tramways and Electricity Committee. The report covers the year ended March 31, 1916, and shows that the total revenue amounted to £280,641, while the working expenses were £159,801, making a trading profit of £120,840, an increase of £7,515 as compared with the results of the previous year. The net revenue charges included interest on debt, income-tax, etc., and, deducting the credit balance on Glengormley Pleasure Grounds account, amount to £64,104, leaving a sum of £56,735 (an increase of £5,235) for appropriation, which is strictly defined by the Aberdeen Clause of the Belfast Tramways Act, 1904, and is as follows :—

Sinking fund	£32,434
Depreciation fund	17,000
General purposes fund (amount promised for 1915-1916)	5,000
General purposes fund (on account of £15,000 promised for 1916-1917	2,302

Mr. Nance calculates that the payments to the dependents of employees with the forces, which are included in the working expenses, and the war bonuses, amount to £10,081. Notwithstanding the serious additions to expenditure, the increased cost of power and material, etc., all the usual financial charges, including depreciation, have been fully met. A year ago Mr. Nance estimated that the total receipts would reach £283,000. He calculates that £2,090 were lost by reducing the service for eleven weeks on some of the routes from a ten to twenty minutes service, which, it may be added, was contrary to his advice. If the amount thus lost be added to the actual receipts it produces £283,004, a sum very nearly the same as the original estimate. The results for the current year ended March 31, 1917, Mr. Nance estimates as follows :—Total receipts, £298,750 ; working expenses, £165,120 ; trading profit, £133,630 ; net revenue charges, £64,450 ; net profit, £69,180 ; appropriation charges, £52,000 ; surplus, £17,180.

Manchester Corporation Tramways.—Alderman J. Bowes presided over a meeting of Manchester Tramways Committee, at which the general manager (Mr. J. M. McElroy) submitted the estimates of receipts and expenditure for 1916–17. The estimated receipts are £950,365 (including the transfer of £10,865 from the reserve fund to meet extraordinary expenditure), as against an approximate income of £939,416 for the past year. The estimated expenditure for the current year is £950,365. The Committee agreed to contribute £100,000 in relief of the rates, as on two previous occasions, but to do this they may have to take £10,865 from the reserve fund. This rate contribution was fixed by the Council three years ago, and before another year passes a fresh arrangement will be proposed by the Committee, who regard the position of affairs as very serious, owing to the large payments in respect of war service allowances. The general manager submitted the following statement in connection with the estimates :—

	1914.	1915.	1916.
Total revenue	£925,310 ...	£901,876 ...	£939,416
Car miles run	19,463,646 ...	19,155,051 ...	18,486,440
Revenue per car mile	11·41d. ...	11·3d. ...	12·196d.
Passengers carried ...	205,608,741 ...	202,768,420 ...	209,853,344

Last year's revenue was higher than that of the year 1914, which was a record year. The earnings per car mile were 12·196d., which is a much higher figure than in any previous year. Although the number of passengers was greater, the ordinary working expenses were considerably less than either of the two preceding years, as will be seen by the following table :—

	1914.	1915.	1916.
	£	£	£
Traffic expenses	276,663 ...	273,002 ...	261,968
General expenses	89,420 ...	85,809 ...	88,484
Repairs and maintenance ...	89,649 ...	85,280 ...	81,594
Power expenses	129,492 ...	128,350 ...	130,390
	£585,224 ...	£572,411 ...	£562,436

The increase under the head of general expenses for the past year as compared with the previous year is due to an increase in the amounts paid in local rates. During the past three years the local rates paid to the city and the various out-districts were as follow, viz. :—1914, £45,154 ; 1915, £45,794 ; 1916, £49,507. The increase in the power expenses is due to the greater price paid for electrical energy owing to the higher cost of coal. The prices per unit charged by the Electricity Department for the last three years were as follow, viz. :—1914, 1·026d. ; 1915, 1·023d. ; 1916, 1·085d. (estimated). If the same price per unit had been paid last year as in 1914 the total of the power expenses would have been £123,474 instead of £130,390.

The estimates for the current year are based upon an estimated car mileage of 18,500,000. The sum of £40,000 estimated for income tax may be considerably reduced if the Trading Committee succeed in convincing the arbitrator that their view of this matter is the correct one. In this event the Tramways Committee would not only be able to avoid having to make the transfer from the reserve fund to meet the estimated deficiency, but would be able to pay to the credit of such fund a sum of about £10,000.

The large payments in respect of war service allowances were a very serious drain on the financial resources of the department.

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The following are the figures for the past two years and the estimated figure for the current year :—Year ended March 31, 1915, £31,764 ; 1916, £92,881 ; 1917 (estimated), £94,000 ; total for three years, £218,645.

The committee had only been able to meet the payments in respect of war service allowances by transferring less sums each year to the reserve and renewals fund.

Record Results at Leeds.—The accounts of the Leeds tramways were, we believe, the first municipal tramway records for the year ended March 31 last to be published. Mr. J. B. Hamilton, general manager, was able to present to the Tramways Committee a draft statement of the receipts and expenditure on April 17. After the committee had considered the statement, the chairman (Alderman R. A. Smithson) expressed satisfaction with the result of the year's working, and, on behalf of the committee, complimented the general manager and his staff upon their labours. Owing to the large number of motormen and conductors who have joined the forces, the department were unable to utilise fully the stock of cars. The extension of the tramways in the Wharfedale district added 17,000 to the population served by the tramways. We append a comparison of the receipts and expenditure from the financial statements of the past three years :—

	Year ended March 31.		
	1916.	1915.	1914.
	£	£	£
INCOME :—			
Traffic revenue	467,197	429,902	423,516
Advertising	2,620	3,915	3,822
Mineral haulage	634	—	—
Rents	5,054	693	117
Total	£475,505	£434,510	£427,455
EXPENSES :—			
Traffic	114,724	115,601	113,819
General	41,190	40,347	41,144
Repairs and maintenance ...	42,786	43,609	41,020
Power expenses	16,837	14,035	24,345
Energy purchased	15,178	14,542	6,054
War bonus to employees ...	5,512	—	—
Total	£236,227	£228,134	£226,382
Balance—Net revenue	239,278	206,376	201,073
Bank Interest	4,443	1,343	2,674
Dividends on investments	5,867	6,493	5,679
Total	£249,588	£214,213	£209,427
Interest	3,818	3,818	2,784
Interest on capital	49,474	44,527	42,176
Income tax	15,349	7,356	5,343
Rent of lines	3,071	3,125	3,223
War allowances	13,270	4,460	—
Balance to appropriation fund ...	165,204	151,526	155,898
APPROPRIATIONS :—			
Redemption fund...	72,488	57,572	53,914
Cost of Acts	703	258	403
Renewal of permanent way ...	3,146	7,771	31,576
Renewal of rotary converter ...	—	4,156	—
Third party risk reserve ...	2,044	—	—
Reserve fund	15,000	—	—
Net surplus	71,821	81,567	70,004

As compared with the previous year, we have the following results :—

	Year ended March 31, 1916.	Year ended March 31, 1915.	Increase + Decrease −
Receipts ...	£475,661	£434,510	£41,150/11 + (9·47%)
Miles run ...	9,405,121	9,522,737	117,616 − (1·23%)
Passengers ...	103,453,801	95,639,266	7,814,533 + (8·14%)
Receipts per mile	12·138d.	10·951d.	1·187d. + (10·84%)
Average fare paid per passenger	1·080d.	1·075d.	0·005d.
Population served	542,000	525,000	17,000 + (3·23%)
Times population carried ...	191	182	9 + (4·94%)
Amount paid per head of population	17/2	16/4	10d. + (5·10%)

The working expenses were again under 50 per cent. of the revenue.

CONTRACTS AND ORDERS.

The Motor Rail and Tramcar Company, Limited, Lombard Street, E.C., have supplied a number of petrol tractors to the War Department.

Siemens Brothers and Company, Limited, have received an order for the supply of two and a half miles of service cable from Leyton Urban Council.

Edgar Allen and Company, Limited, have obtained a contract for supplying and supervising the fixing of points and crossings for Gloucester Corporation Light Railways, and for a lay-out for Leyton Council Tramways.

Darlington Council have accepted the tender of Messrs. Babcock and Wilcox, Limited, for the supply and erection of coal-handling plant at the electricity works, and of B. Blackett and Sons for overhead coal bunkers.

Bradford Electricity Committee have accepted the following tenders :—Musgrave and Company, Limited, induced-draught plant and two steel chimneys ; Electromotors, Limited, three fan motors ; Ferranti, Limited, two 250 k.v.a. transformers.

West Ham Council have been recommended by the Electricity Committee to extend for two years the contract of the British Westinghouse Company for the supply of transformers, with the addition of a sliding scale based on cost of material and labour.

Wolverhampton Electricity Committee have recommended acceptance of the following tenders :—Brush Electrical Engineering Company, two 300 KW. transformers ; Reyrolle and Company, switch gear ; Stirling Boiler Company, two boilers, two superheaters, and two sets of mechanical stokers.

Dover Tramways Committee offered the contractors for the supply of tickets an increase of 5 per cent. instead of 10 per cent., as requested. Although the company pointed out that the war had invalidated existing contracts, the committee have decided to adhere to their previous offer. The Municipal Tramways Association wrote that the Paper Commission stated that there should be no difficulty in obtaining an adequate supply of tickets.

Johannesburg Council have been recommended by the Tramways and Lighting Committee to accept the appended tenders :—Two 3,000 KW. turbo-alternator sets, with Parsons condensing plant, switch gear, and cable connections, erected complete, including excavations and foundations, Sykes and Company, £26,395 ; spare rotor, Sykes and Company, £798 ; wet air filtration plant, of capacity not less than 36,000 cubic feet of air per minute, Griffin Engineering Company, £690.

Brake Blocks.—In reply to remarks made at a meeting of Belfast Council in regard to tenders for brake blocks, Councillor M'Caughley, chairman of the Tramways Committee, said the tenders were dealt with in the usual way. The cross-channel firm quoted £8 9s. for a twelve months' contract, and the local firm would only contract for six months at £9. Slipper blocks were quoted at 9s. and 12s. 6d., and the Belfast firm's figure was 16s. 2d. If the Corporation wanted the local firm to get the contract, he had no objection.

Salford Electricity Committee have accepted the following tenders : Two 1,000 KW. rotary converters, British Westinghouse Electric and Manufacturing Company, Limited, £5,590 (including £400 for contingencies) ; one 500 KW. rotary converter, General Electric Company, Limited, £1,579 15s. (including the sum of £100 for contingencies) ; two water-tube boilers, superheaters, economisers, induced-draught plant, mechanical stokers, flues, and chimneys Babcock and Wilcox, Limited, £11,544 (including £500 for contingencies.)

The Woods-Gilbert Rail Planer Company, 2, Norfolk Street, London, W.C., are carrying out a contract for remodelling the rails of Bexley Urban Council tramways. In the Woods-Gilbert process a special machine is used which deepens the groove, cuts down the guard lip, and removes corrugations and the dish at joints. Bolton Tramways Committee have also entered into a contract with the company for the treatment of their rails in the same way. This contract was placed after the sub-committee had inspected the successful work done by the company at Wigan.

The Victorian Railways Department have placed the following contracts :—British Westinghouse Company, frequency changers and rotary converters for Spencer Street and Elwood sub-stations ; R. W. Cameron and Company, battery signal machines and Ackley brakes ; McKenzie and Holland, electric point and lock detectors ; Noyes Brothers, toggle insulators for St. Kilda-Brighton electric railway ; Gibson, Battle and Company, 15-ton electric crane, etc., £1,596 ; Forman and Company, railway and electric tramway crossing, £229, and steel anchor bolts for overhead equipment.

Delivery of Motors.—Mr. G. F. Craven, general manager, Reading Corporation Tramways, has reported that Messrs. Dick, Kerr and Company, Limited, are prevented by the Minister of Munitions from delivering the six car motors that were ordered in November last. At the request of the representative of the Minister of

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Munitions, he had attended at Armament Buildings and pointed out that the motors were needed to reduce the repair work, that the cars were carrying munition workers, and that Government work was being done in the repair shop. The representative, however, had recommended the Minister to refuse a certificate to Messrs. Dick, Kerr and Company on the ground that the motors were not needed for cars used exclusively for carrying munition workers. The controllers, which were ordered at the same time, had been delivered.

Salford Tramways Committee have accepted the tender of Scholey and Company, Limited, 56, Victoria Street, London, for a supply of steel tires, at £1,055, and that of Brown-Bayley's Steel Works, at £932 10s., also for steel tires. The following contracts for annual supplies have been placed :—

Car Accessories (Mechanical).—W. J. Ritchie and Company, National Rail and Tramway Appliances Company, and Anti-Attrition Metal Company.
Ears, Frogs, Pull-offs, etc.—British Insulated and Helsby Cables, Watlington and Company, J. Hall, and British Westinghouse Company.
Iron and Steel.—J. Kidd and Sons, and Vickers Limited.
Special Car Accessories.—British Westinghouse Company.
Wire, Solder, Lead, and Tin.—British Insulated and Helsby Cables, L. Andrew and Company, R. Johnson, and Clapham and Morris.
Special Paints and Varnishes.—Nobles and Hoare.
Trolley Cord.—L. Andrew and Company.
Car Accessories (Electrical), Insulating Materials, etc.—W. McGeoch and Company, W. T. Henley's Telegraph Works Company, General Electric Company, L. Andrew and Company, British Westinghouse Company, Micanite and Insulators, Limited, North British Rubber Company, Griffiths Brothers (insulating varnishes), C. Macintosh and Company, British Insulated and Helsby Cables, Siemens Brothers Dynamo Works, Le Carbone, Limited, H. Norbury and Company, Gabriel and Company, and W. Boydell and Sons.

PERSONAL.

Dr. E. Hopkinson has been appointed a member of the Indian Commission on Industrial Development.

Mr. J. G. Potts, superintendent of Bury Council Electricity Works, has had his salary increased from £180 to £200.

Mr. W. H. Beable, vice-chairman of the Sales Managers' Association, is visiting Russia as the representative of various firms to open up new trade avenues.

Mr. T. Law, of Rotherham Corporation Tramways staff, has been presented with a clock by the employees at the depot, on the occasion of his marriage with Miss H. Moon.

Mr. H. Pilling, general manager and engineer of the Accrington Corporation Tramways, has been granted an increase in salary of £50 by the unanimous vote of the Town Council.

Mr. H. Dickinson, Liverpool city electrical engineer, has accepted an invitation to advise Wigan Council as to the improvement of their electric supply undertaking. The fee will be 150 guineas.

Mr. S. L. Pearce, city electrical engineer, Manchester, has been permitted by the City Corporation to advise the authorities of Rochdale, Chesterfield, and Stafford on proposed extensions of their electricity works.

Rotherham Council have increased the salaries of the traffic superintendent (Mr. H. Jagger) and the chief traffic clerk (Mr. C. Webster) from £150 to £162 10s. per annum, with further advance to £175 on March 25, 1917.

Mr. G. W. P. Page, who for the past two years has been engaged chiefly on publicity and other technical work in the publication department of the General Electric Company, has enlisted in the London Electrical Engineers.

Mr. Clifford C. Paterson, principal assistant in charge of electrotechnical and photometric buildings at the National Physical Laboratory, has arranged to join the Osram-Robertson Lamp Works, Limited, as director of laboratories for research and technical manufacturing purposes.

Alderman H. W. Littler, the chairman of the Tramways and Electricity Committee of West Ham Corporation, has resigned his membership of the Council. The Committee have passed a resolution expressing high appreciation of his services in the development of the two undertakings.

Mr. R. L. Horsfield, general manager, Walsall Corporation Tramways, has had his salary increased by £100 per annum. Alderman J. Cope, chairman of the Tramways Committee, informed the Council that no application was received from Mr. Horsfield ; the proposal was solely that of the Committee.

Mr. J. F. Cameron, general manager and electrical engineer, Northampton Corporation Tramways, stepped into a six-feet deep inspection pit in the darkness while supervising repair work at the generating station in April 22. He sustained fractures of two ribs. Two or three days later he returned to duty.

Mr. F. Schofield, manager of Leyton Council Tramways, having had to undertake additional duties consequent upon the Council deciding not to insure against third party risks, the Tramways Committee recommend that his salary be increased from £400 to £425, to be followed by annual increments of £25 until it reaches £500.

Mr. P. J. Pringle, M.I.E.E., M.I.M.E., has been appointed consulting engineer and assessor to the Tramway Board recently formed, and will act in connection with the transfer of the Melbourne Tramway and Omnibus Company's undertaking to the Tramway Board. Mr. Pringle is general manager and chief engineer of the Electric Supply Company of Victoria, Limited, and will continue to discharge these duties.

Mr. E. G. Moggridge has been appointed by the Board of Trade to the position of assistant secretary of the railway department of the Board of Trade, in place of Mr. W. F. Marwood, who has been appointed second secretary to the Board. Mr. Moggridge was formerly assistant secretary to the marine department. Mr. C. Hipwood becomes assistant secretary of the marine department in place of Mr. Moggridge.

Mr. C. P. Sparks has been nominated for a second year as President of the Institution of Electrical Engineers, Mr. J. S. Highfield for re-election as vice-president, and Mr. R. A. Chattock as a new vice-president. Mr. J. Devonshire, of the allied Tramways Companies in London, and Mr. J. O. Callender, assistant manager of Callenders' Cable and Construction Company, are nominated by the Council for vacancies as associates on that body.

Mr. A. L. C. Fell, the chief officer of the London County Council Tramways, has recently passed through a serious and critical illness. He is now approaching convalescence, but it will be some two months before he can resume duties. Meanwhile his place will be taken by Mr. J. K. Bruce, the deputy chief officer of tramways, particularly as one of the representatives of the Council on the Rolling Stock and the Permanent Way and Building Conciliation Boards.

Mr. E. Powell has been unanimously re-elected president of the Society of Motor Manufacturers and Traders. In the report of proceedings for the year 1915, presented to the new Council, it was pointed out that in spite of the absence of exhibitions, trials, competitions, etc., there had been a number of meetings beyond the average. Some of these were special meetings, dealing with subjects to which the president had given personal attention, and as similar matters were likely to continue to require attention on behalf of the industry generally, the unanimous desire was expressed that Mr. Powell should consent to retain office, which, in the circumstances, he agreed to do. The new vice-presidents are Mr. A. Brown and Mr. E. Hopwood.

Mr. Edgar Peckham, of Queen Anne's Chambers, Westminster, who is well known in connection with the Peckham tramway truck in America and Europe, has invented a smoke-consuming device. The invention can be applied to steam boiler furnaces and also to domestic stoves and grates. Besides rendering them smokeless, the device, according to Mr. Peckham, will greatly reduce the consumption of coal. This result is of especial importance at a period when fuel has become very costly. In Manchester and other manufacturing districts, where the question of smoke prevention has been given special study of late years, Mr. Peckham's appliance should be assured of a trial. We understand that he desires to obtain assistance towards that end.

Mr. Percy Priestley, general manager and engineer, Mexborough and Swinton Tramways Company, has been selected by Oldham Tramways Committee for appointment by the Council as general manager of the tramways undertaking, at an initial salary of £400. The directors of the company will regret the departure of Mr. Priestley, who has had charge of their undertaking since 1907. He was formerly assistant manager of Halifax Corporation electricity undertaking, and is 41 years of age. Forty-seven applications were received for the Oldham vacancy, and the following candidates were selected for an interview, in addition to Mr. Priestley :—Mr. H. Pilling, general manager, Accrington Corporation ; Mr. W. Billington, assistant manager, Salford ; Mr. J. Brierley, chief inspector, Oldham ; Mr. F. Buckley, general manager, Wigan ; Mr. W. Chamberlain, joint electrical engineer and manager, Oldham ; Mr. H. J. Jackson, chief assistant to the traffic superintendent, Manchester ; Mr. A. Eardley, manager, Stockport ; Mr. J. Wood, general and confidential assistant, Liverpool.

Alderman J. H. Aston, of Huddersfield, died on April 13. He was for nine years chairman of the Tramways Committee, and retired in November last on account of ill-health. The Committee at that time placed on record their high appreciation of his services.

Mr. G. Proudman, who has died at Birkenhead, was a former chairman of the Tramways Committee of that borough. He had been in the service of the London and North Western Railway Company for 45 years at Broad Street Station, London, and at Birkenhead.

WITH THE FORCES.

Lieutenant E. T. Jones, formerly in the employ of Sheffield Tramways Department, has been mentioned in dispatches.

Second-Lieutenant H. P. Bramwell, who at the outbreak of the war was with the British Thomson-Houston Company, has been wounded while engaged in photographic work in an aeroplane.

Corporal J. W. Smith, a Nelson Corporation tramcar conductor, has been awarded the D.C.M. The Tramways Committee have passed a resolution expressing appreciation of his gallantry.

Lieutenant H. C. Clifton, East Lancashire Regiment, who has been killed in action while serving with the Kut relief force, was an electrical engineer with Messrs. Siemens Bros. at Woolwich.

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Private R. F. Sparling, 9th Lancers, who for three years before the war was a Manchester tramways motorman, has been awarded the D.C.M. for conspicuous bravery at Loos, where he was wounded.

Lieutenant R. F. Parkinson, R.E., who has been awarded the Military Cross for conspicuous gallantry in France, was an assistant on the engineer's staff of the Tilbury section, Midland Railway.

Lieutenant J. Briggs, R.E. Railway Troops, late an engineering assistant in the western divisional engineer's office of the Midland Railway at Derby, has been promoted to temporary captain. He has been in France since February last.

Second-Lieutenant T. O. H. Bates, 89th Punjabis, died on April 12, of wounds received in action. He joined the Indian Army from the position of chief electrical engineer to the Tata Steel and Iron Company, Bombay, and was formerly engineer in charge at Morley Corporation electricity works.

Flight-Lieutenant G. H. Reid, of the Royal Naval Air Service, and late of Callender's Cable and Construction Company, was taken prisoner during the British seaplane raid on the enemy's airships depot in Schleswig-Holstein. He was captured while his machine was in difficulties on the sea after he had rescued Sub-Lieutenant Hay from his disabled seaplane under heavy fire.

Lieutenant W. A. Blythe, 12th Siege Battery, R.G.A., has been awarded the Military Cross for conspicuous gallantry as forward observing officer. For more than a fortnight he was repeatedly under fire, and his telephonist was killed at his side on the last day. Lieutenant Blythe, who was engineer to Hill's Patent Motor Vacuum Road Cleanser, Limited, received his commission in November, 1914, and was at the front for nearly a year before being sent into hospital suffering from concussion and gas.

Sergeant W. R. Smethurst, Royal Sussex Regiment, a motorman on the Salford Tramways, was, on April 18, presented with the Distinguished Conduct Medal for gallantry on September 25 last at Le Rutoire (Loos). During that engagement the officers of his company had been put out of action, but the sergeant took command, although he had been seriously wounded. By his bravery and example he materially assisted in the attack. The presentation was made at a meeting of the Tramways Committee by Alderman Worsley, the Deputy Mayor. On behalf of the Tramways Committee, Alderman Linsley, the chairman, handed the sergeant an illuminated copy of a resolution passed by the committee, congratulating him upon the distinction he had won. In reply, Sergeant Smethurst, who before the war was a reservist, stated that his period of service had now expired, but he was not going to claim his discharge.

Lance-Corporal C. Taylor, East Lancashire Regiment, who has been killed on active service, was a conductor on the Leeds tramways.

Lieut.-Colonel Gurney Sheppard, one of the directors of the Mersey Railway, fell during the Dardanelles operations. At the annual meeting of the company, Mr. J. Falconer, M.P. (chairman) expressed the directors' profound regret at his death.

The Late Captain J. H. Courtis, Oxford and Bucks Light Infantry, son of Sir John Courtis, chairman of Cardiff Tramways Committee, is mentioned in the despatch forwarded to the War Office by General Sir John Nixon, relative to the operations in Mesopotamia, from April to September, 1915.

RAILWAY OFFICERS AND STAFF.

Mr. F. E. Jacobs has been elected chairman of Rhondda and Swansea Bay Railway Company.

Mr. Thomas Richardson has been appointed chairman of Belfast and County Down Railway. He has been a director for twenty-one years.

Mr. R. C. Willis, on promotion to the position of registrar of the London and North Western Railway Company, has been presented with a cabinet of cutlery by his colleagues in the audit department. Mrs. Willis received a gold bracelet.

Mr. R. W. Reid has been appointed works manager of the Midland Railway carriage and wagon department, in succession to Mr. T. James, retired. Mr. Reid, who has been with the Midland Company since August, 1909, is the son of Mr. W. P. Reid, locomotive superintendent of the North British Railway.

Mr. A. C. Rumboll, general traffic manager, Great Indian Peninsular Railway, is one of the members of the committee formed to collect information with a view to its use in the provision of railway facilities at Delhi, the new capital of India.

Sir Guy Granet, general manager, Midland Railway, has temporarily been appointed to act in an honorary capacity as controller of a new department termed the Department of Import Restrictions. It has been formed by the Government to give effect to the prohibition or restriction of imports of certain goods to meet the present and apprehended deficiency of tonnage. The office of the department is at 64, Victoria Street, S.W.

Tramway Material for New Zealand.—The Takapuna Electric Tramways Company, Auckland, has decided to raise the sum of £50,000 for the electrification of the existing steam tramway.

TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.

TRAILER CAR EXPERIMENT.—OMNIBUSES TO RELIEVE PASSENGER CONGESTION.

The Tramways Committee, who recently made inquiry as to the working of trailers in London, have decided to experiment with the running of a trailer on the Handsworth route. Several motor omnibuses have been delivered out of twelve that were ordered in February last. By this means relief has been given to the congestion on several routes. Owing to the decision of the committee to postpone until after the war the scheme for a tramway from Salford Bridge to Tyburn, omnibuses are being provided for the conveyance of workers in that district.

BLACKPOOL.

THROUGH RUNNING AGREEMENT.

The Corporation Tramways Committee have, with the consent of the Council, decided that the privilege of running cars on the Corporation's tramways should be granted to the Blackpool and Fleetwood Tramroad Company and the Blackpool, St. Annes and Lytham Tramways Company on the terms of a through running agreement in each case.

BRADFORD.

VOLUNTEER MOTORMEN.—LOSSES THROUGH ENLISTMENT AND MUNITION WORK.—PENALTY FOR QUEUE INFRINGEMENT.

Six volunteer motormen, representing various grades of society, are engaged on the Bradford cars on Saturdays and week-ends. Others are undergoing training. The department up to March 31 had lost about 500 men through enlistment and transfer to Government work. Of the men who entered the forces 14 have been killed in action and 49 wounded, while five are prisoners of war in Germany. The Board of Trade have approved of the regulations recently made by the Corporation, at the instance of the Watch Committee, requiring that if there are six or more persons waiting for cars at any specified place they must stand in proper order in a queue. This applies to places where there are no barriers as well as where barriers exist. The penalty for infringing the rule is a fine not exceeding 40s.

COLWYN BAY.

THE QUESTION OF DOUBLE-DECK CARS.

Colonel Druitt, R.E., has reported to the Board of Trade in favour of double-deck cars being allowed to run on the Old Colwyn and Penrhyn Bay section of the Llandudno and Colwyn Bay Electric Railway Company, but he recommends that certain parts of the track should first be repacked. Colonel Druitt found the line for the most part very well laid and equipped, and recognised the difficulties in obtaining the necessary labour for maintenance during the war.

GATESHEAD.

BOARD OF TRADE AND THE RUNNING BACK ACCIDENT.

The Railway Department of the Board of Trade have informed Gateshead Council that Colonel von Donop, R.E., in his report with reference to a car running back on Bensham Bank, has informed the company that a slight change in the position of Ravensworth loop would provide a better gradient for cars to stand on, and, further, recommended that a rule be issued providing that motormen should not leave their cars during the journey. The Tramways Company have written the Council to the effect that they were prepared to carry out the suggestions in regard to the lengthening of the Ravensworth loop. The directors were in favour of a double line for the full distance, and they submitted that as part of a scheme. They were also in favour of double lines on all gradients. Strict instructions had been given to motormen not to leave their cars, except in special circumstances, and to apply hand and track brakes when stopped on a gradient.

LEEDS.

MINERAL HAULAGE.

During the year ended March 31, Leeds Corporation Tramways Department received £633 for haulage of minerals for a colliery company from Harehills to their works in Oldfield Lane and Elland Road.

LEICESTER.

THE CRITICAL PERIOD OF A TRACK.—COST PER YARD FOR CORRUGATION GRINDING.

In his annual report to the Tramways Committee, Mr. E. G. Mawbey, borough engineer, states that the track is in very good order, considering that it has had nearly twelve years' service, but he considers that it will require careful watching, as it has reached a critical period. A fair stock of rails bought before the great rise in prices is in hand. The length of rails ground during the year for the removal of corrugations was 11,655 yards, at an average cost of 1·365d. per yard. The cost of maintenance and repair work showed a diminution due to economies effected owing to the war. The expenditure was £5,931, as compared with £6,498 in 1914 and £6,956 in 1913. Various new points and crossings were fixed, and

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a number of curves and junctions relaid with heavy silicon steel rails. The widening of the Haymarket and Belgrave Gate, and the doubling of the track through this portion of the Belgrave route has greatly facilitated the traffic, both tramway and general, and has enhanced the appearance of the centre of the town.

LONDON.

M.E.T. to Use Trailers.—Higher Fares in East Ham.—Woolwich Track Doubling.—Ilford and Penny Universal Fare.

The Metropolitan Electric Tramways, Limited, have applied to the Board of Trade for permission to use trailer cars along the tramways and light railways running from Acton to Paddington, and from Paddington via Craven Park and Cricklewood to Hendon in order to meet certain temporary difficulties. Kensington Council will raise no objection to the running of such cars in their district during the period of the war. Trailers are now operated on three of the South London routes of the London County Council Tramways. The third service—from the Embankment to New Cross—was started towards the end of April, and the other services are to Tooting and Norbury, at which places the London United and the Croydon Tramways respectively have a terminus. The services work with great smoothness, and are a great convenience. The trailers and the couplings were fully described and illustrated in our issue of October 14 last. Alderman M. Oakes, chairman of East Ham Tramways Committee, has reported that in the first week of the new fare stages the receipts increased by £900. That continued until the omnibuses started the same fares, and even a little longer. A more direct effect was the increased service of omnibuses. Another thing that had lately reduced the takings was the early closing. The Ministry of Munitions have informed Woolwich Council that the widening of the tramway track at various places is a matter of extreme urgency. The Council have consequently informed the London County Council that they have no objection to immediate doublings at two places where no street widening is required. With a view to inviting the assistance of the Ministry in the matter of widenings at other points, the Borough Council have invited the County Council to form a joint deputation to wait upon the Ministry. Mr. L. E. Harvey, manager and engineer, Ilford Council Tramways, has advised the Tramways Committee to consider the question of instituting the penny universal fare. In view of the increased working expenses he suggests that the scheme should be adopted for the duration of the war.

NEWCASTLE-ON-TYNE.

Increase of Workmen's Fares.—Extension of Services.

The Corporation on May 3 adopted a recommendation presented by the tramways committee to increase the prices of the coupon tickets issued to workmen. In future there will be no travelling at reduced fares unless the passenger produces a coupon ticket. These are sold in packets of a dozen. The fare has been increased owing to the higher cost of working. It was also recommended that half fares to soldiers and nurses be continued, but that the minimum fare be one penny instead of a halfpenny. The Council, however, did not adopt the latter recommendation. Councillor R. Mayne, chairman of the committee, in proposing the adoption of the recommendations, said that instead of making 2d. per car-mile on the workmen's traffic they were making scarcely ½d., which was not enough to pay for renewals, to say nothing of any contribution to the rates, which would be badly wanted next year. The undertaking as a whole was remunerative. Since April 14 the service of cars, which had been reduced owing to the restricted lighting and shortage of staff, has been extended by an hour, the last car on some routes leaving shortly after 11 p.m.

PLYMOUTH.

Cost of Devonport Tramways Acquisition.

The costs incurred by Plymouth Corporation in connection with the Devonport and District Tramways arbitration totalled £7,736, the several items being:—Witnesses, £2,879; counsel, £1,350; agents, £205; committee's expenses, £118; officers' expenses, £30; printing, £235; miscellaneous expenses, £190; arbitrator's fee, shorthand note, and printing of proceedings, hire of room, etc. (one-half payable by Corporation), viz., £1,415; stamp duty on transfer, £1,040. Upon the statement being presented to the Council on April 10, Councillor Bond stated that the company asked £200,000 for the undertaking, and as the result of the arbitration the Council had to pay only £111,000, while their costs were £7,735. The Corporation have received sanction to the borrowing of £111,706 in respect of the purchase. The repayment is to be spread over thirty years.

SWANSEA.

Corrosion of Steel Guard Wires.

The electrical engineer to the Corporation has reported that a number of breakdowns of overhead equipment on the Morrison tramway route were due to the falling of guard wires. The Tramways Company have decided to re-equip about six miles of line with bronze guard wire, owing to the steel wire having become badly corroded.

TRAMWAYS AND LIGHT RAILWAYS CONGRESS.

Programme of Annual Congress.

The following are the provisional arrangements for the Tramways and Light Railways Association's annual congress, to be held on Friday, June 30:—

2.30 p.m.—Annual general meeting, Westminster Palace Hotel, S.W.

3 p.m.—Paper by Mr. W. Tuke Robson, A.I.E.E., general manager, Southampton Corporation Tramways. Discussion to follow.

4 p.m.—Visit by special omnibuses to the London General Omnibus Company's Training School, Milman Street, Chelsea, where members will be received by Mr. H. E. Blain, operating manager of the L.G.O. Company, and the Underground Railways.

Inspection of class-rooms, drivers' and conductors' courses, mess-room, clothing stores, etc., and cinematograph hall, where special films will be exhibited showing London traffic scenes, with special reference to rules of the road for tramcars, omnibuses, and other traffic methods of training, etc. This will be followed by tea, during which Mr. Blain will give a short address on "The Safety Movement."

7.30 p.m.—Members' dinner at the Trocadero.

The members of the Council to retire by rotation at the annual meeting are Messrs. C. Shirreff Hilton, S. E. Baker, J. W. Dugdale, T. B. Goodyer, H. L. Williams, and John Cameron.

DON'TS FOR WOMEN CONDUCTORS.

The following instructions, printed on a small card, have been issued to the women conductors employed on the Birmingham Corporation Tramways:—

1.—**DON'T** signal to the driver to proceed until perfectly sure that all intending passengers have been picked up and the platform is clear. Neglect of this precaution has caused **serious injury** to many passengers.

2.—**DON'T** ring the bell for the car to start when **inside.** It is impossible to see that the platform is clear from inside, and it looks **lazy.**

3.—**DON'T** fail to report all accidents, no matter how **trivial,** upon the proper form and on the day of occurrence; witnesses must be obtained when possible; if unobtainable, the reason should be stated. Failure in this respect results in the Tramways Department having to pay **compensation** that would not be paid if the full facts were available.

4.—**DON'T** fail to **call** out all stopping places as clearly as possible; it prevents a lot of grumbling.

5.—**DON'T** fail to be **smart, clean, and polite** at all times; the good name of the department is mainly in the hands of the employees.

6.—**DON'T** be late for duty. Tramway workers must be **punctual,** otherwise the passengers cannot be.

7.—**DON'T** make mistakes in the time or relieving point when taking down the duty; considerable mileage is lost through **carelessness** in this respect.

8.—**DON'T gossip.** Passengers' questions should be answered politely, but the conversation should not be continued. The work generally is being neglected when this regulation is not observed.

9.—**DON'T** ride on the motorman's platform under any circumstances. The motorman has enough to do to avoid **accidents.**

10.—**DON'T** fail to obtain the **legal fare** due from each passenger, and **don't** be careless with the tickets. Tickets issued **out of order** cause considerable unnecessary work and often get lost. Tickets not returned are charged for.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in *italics.*

Applications for Letters Patent.

The following applications for Letters Patent were filed previous to April 21, 1916:—

Self-propelled vehicle (4,843)—Baguley Cars, Limited, and E. W. Baguley.

Steam turbines (5,020)—K. Baumann.

Steering and fore-carriage mechanism for motor vehicles (5,146)—F. J. Bretherton, and Clayton and Shuttleworth, Limited.

Electrical driving for motor vehicles (4,962)—H. Crochat.

Gear boxes for automobiles (4,842)—T. Gill.

Electrically bonding rail ends (5,092)—J. C. Lincoln.

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Apparatus for indicating the speed of vehicles (5,086)—D. McNeill.
Steering and fore-carriage mechanism for motor vehicles (5,146)—P. W. Robson.
Elastic or resilient tires for road vehicles (5,148)—J. F. van der Velde.
Railway switch or point levers (4,964)—L. W. Williams.
Steam motor road vehicles (5,352)—Bleachers' Association.

FOREMAN PLATELAYER.

Wanted, Working Foreman Platelayer, permanent job. Apply, giving particulars of experience and wages required, Engineer and Manager, Rhondda Tramways Company, Ltd., Porth, Glam.

FOR HIGH-CLASS

CONDENSING PLANT

WRITE TO

THE MIRRLEES WATSON CO., LTD.,

SCOTLAND STREET, GLASGOW.

ORIENTAL

The name ORIENTAL has always been associated with highest grade

SEAMLESS STEEL TUBES

—it's a name that is recognised throughout the Trade as a guarantee of quality, strength and accuracy. We also make Electric Welded, Butt Welded and Close Joint Steel Tubes. Ask us to quote you.

ORIENTAL TUBE CO., LTD.,
WEST BROMWICH.

'Grams: "Tubes, West Bromwich."
'Phone: 45, West Bromwich.

Railway and tramway ticket holders (5,344)—T. Bowden.
Railway vehicles (5,247 and 5,248)—T. F. Craddock (*Burn and Company and another*).
Lifeguards for vehicles (5,235)—P. Deamer.
Ramps for re-railing vehicles (5,438)—V. I. Feeney.
Lubrication of motor vehicles (5,361)—J. B. Ferguson.
Motor vehicles (5,485)—A. Good.
Motor driven vehicles whereof the motor may be utilised for driving the vehicle or dynamo carried thereon (5,259)—J. L. Gordon.
Side-splash guards for vehicles (5,316)—H. V. N. Graveley.
Train-stopping apparatus (5,238)—A. X. W. Grondin.
Stations or stopping place indicator for tramcars (5,213)—C. W. Mallins.
Increasing the tractive power of motor vehicles (5,265)—A. T. Marks.
Steam motor road vehicles (5,352)—D. Morgan.
Motor road vehicles (5,565)—F. Sumner-Smith.
Lubricating devices (5,227)—Westinghouse Brake Company.
Motor road vehicles (5,565)—R. P. Young.
Electrical systems for engines (5,841)—W. A. Chryst.
Differential gear for motor vehicles (5,610)—T. H. Cleathero.
Reinforced concrete railway sleepers (5,701)—C. C. Coade.
Electrical systems for engines (5,841) —C. F. Kettering.
Brake apparatus for railway vehicles (5,866)—E. S. Luard.
Chairs for railway rails (5,626)—H. Lumsdon.
Tubular radiators, condensers, etc., for motor vehicles (5,671)—O. D. North.
Railway signalling apparatus (5,673)—J. P. O'Donnell.
Tablets for train signalling on single lines of railway worked on the electric train tablet block system (5,637)—F. Roberts.
Railway signalling and interlocking apparatus (5,722)—Saxby and Farmer.
Differential gear for motor vehicles (5,610)—F. Spurr.

Specifications Published.

1914.

Device for automatically adjusting railway brakes (10,692)—Bóra.

1915.

Brake for vehicles (3,242)—Barmby.
Motor starting mechanism (4,318)—Mobil-Werke Akt.-Ges.
Train signalling and control systems (5,766)—Woodward.
Motor vehicle bodies (6,851)—Maddox.
Adjustable trailer brake (8,351)—Neate.
Resilient wheel tire (11,554)—Murrey and Wood.
Change-speed gearing for motor vehicles (4,548)—Robinson.
Vehicles and vehicle trains (11,904)—Porsche, Reik, and Oesterreichische Daimler-Motoren Akt.-Ges.
Railway guard rails (16,322)—Betts.
Vehicle wheels (9,755)—Maddocks and Reading.
Turbine apparatus (11,515)—Westinghouse Machine Company.
Railway rolling stock (12,713) Sheffield and F. R. Rand and Company.
Fluid pressure braking apparatus (16,283)—Westinghouse Brake Company.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.		1915. WEEK ENDED. April 3	April 10	April 17	April 24		1916. WEEK ENDED. April 1	April 8	April 15	April 22		AGGREGATE. Wks.	1916.	Increase or Decrease.
		£	£	£	£		£	£	£	£			£	£
Anglo-Argentine	... ...	51,093	47,569	53,734	53,329	...	50,588	52,399	53,462	47,697	...	17	813,468	— 2 933
Auckland	... ...	...	...	...	...	...	...	...	...	...	...	—	—	—
Burma...	... ... Rs.	3,625	3 678	3,473	3,758	...	3,566	3,905	3,690	3,456	...	38	—	+ 7,321
Calcutta	... ... Rs.	62 078 (2 weeks)	59,514	63,972 (2 weeks)	62,452	...	64.334 (2 weeks)	67,169	69,389 (2 weeks)	64.524	...	17	1,089,330	+ 67,441
Madras	... ... Rs.	28,604		30,370		...		30,818	32.361		...	17	251,470	+ 23,409

Companies Issuing Monthly Statements.

	1914. Nov.	Dec.	1915. Jan.	Feb.	March.	April.	1915. Nov.	Dec.	1916. Jan.	Feb.	March.	April.	Wks.	AGGREGATE. 1915 16.	+ or -.
	£	£	£	£	£		£	£	£	£	£	£		£	£
Brazilian Street Mlrs.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Brazilian Traction Mlrs	5929730	6010490	5996190	5797500	6294910	...	6336000	6527000	6430000	6079000	6711000	...	13	19,220.000	+ 1,131,400
Brisbane	28,600	30,890	29,620	34,050	30.740	...	31,120	33,960	32,280	30.320	34,275	...	13	96,875	+ 9,925
British Columbia	$ 648,485	674,063	640,495	558.512	557.135	...	562,782	603,667	591,949	572,935	577.117	...	39	4,982,147	— 772,894
Buenos Aires Pt. & C.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Buenos Ayres Lacroze	42,256	44,000	43,301	38,877	44,332	41,765	42,603	43,528	40,596	39,137	42,219	40.220	43	413,102	— 8,139
Cape Town	...	15,869	15,660	...	...	...	13,870	16,589	16.030	...	14.994	...	—	—	—
Carthagena & Herrerias	1,379	1.255	904	1,822	2 436	1,496	2,090	2,129	2,841	1,585	2,991	2,513	18	9.930	+ 3,272
Cordoba	12,468	12,091	11,945	11,534	12,746	...	13.785	13.025	12,329	11,831	13.598	...	52	161,906	+ 6.251
East India	2,029	1,839	1,914	1,649	1,846	1,864	2,065	2,062	2,015	1,863	2.196	2,116	39	18,706	+ 1,466
Kalgoorlie	2,414	2,905	2,372	2,352	...	...	2,611	3,018	2.236	2,248	...	...	9	4.484	— 240
La Plata	4,540	4,452	4.540	4,016	4.582	...	4.545	4,564	4,533	4,346	4,613	...	13	13,492	+ 362
Lima	29,712	32 411	33,043	30,164	34,185	...	30,703	34,685	34,014	32,900	34,159	...	13	101.073	+ 3,681
Manila	$ 129,000	132,500	...	...	...	...	129,447	141,350	...	...	...	...	52	1,495,534	— 108,031
Melbourne	...	...	62,729	59.086	...	...	...	72,658	69,879	69,395	...	...	9	139,274	+ 17,459
Mexico ...	$ ...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Monte Video	27,081	28,605	32,459	30.008	29 716	26,786	28,407	31,305	34.252	32 502	31,956	28,997	26	187,419	+ 12.764
Fort Elizabeth ...	...	...	...	...	...	...	3,110	4,360	4,193	3,857	...	...	—	—	—
Puebla ...	$ ...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Rangoon	4,405	4,459	4 689	4,991	5,217	4,964	5.028	4,492	4,763	4,674	5,501	4,849	18	19,787	— 74
Toronto ...	$ 824.634	...	843,351	767,326	820,750	...	851,113	...	906,350	846,256	910,969	...	13	2,663,575	+ 232,148
Winnipeg ...	$ 330,398	368,400	350,681	314.658	303,209	...	323,025	377,121	297.560	293,250	296,500	...	13	887.310	— 81.239

(*Continued on page 368*)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1915. WEEKS ENDED.					1916. WEEKS ENDED.					AGGREGATE.		
	April 3	April 10	April 17	April 24		April 1	April 8	April 15	April 22		Wks.	1916.	Increase or Decrease.
	£	£	£	£		£	£	£	£			£	£
Aberdare	319	374	324	341		327	232	363	393		3	998	– 50
Aberdeen Corporation	1,507	1,626	1,620	1,602		1,612	1,756	1,667	1,688		46	81,882	+ 5,102
Accrington Corporation	*	...	...	...		...	...	...	...		—	—	—
Ayr Corporation	254	343	279	280		246	274	279	313		50	17,123	+ 1,071
Bath Electric	*	...	...	...		...	...	...	...		—	—	—
Birkenhead Corporation	1,257	1,362	1,253	1,231		1,438	1,418	1,388	1,459		3½	4,706	+ 145
Birmingham Corporation	6,344	13,995	12,286	12,445		12,379	16,178	15,832	15,461		3	50,639	+ 6,214
Birmingham Corp. Motor Omnibuses	337	863	674	685		575	842	806	767		3	2,578	+ 58
Blackburn Corporation	1,117	1,632	1,167	1,167		1,016	1,227	1,115	1,060		3½	3,930	– 721
Blackpool and Fleetwood	499	802	397	338		351	333	332	754		16	5,479	– 201
Blackpool Corporation	488	1,724	705	667		683	1,216	730	872		3	2,817	– 944
Bolton Corporation	2,755	2,775	2,612	2,516		2,763	2,725	2,619	3,441		4	9,844	+ 116
Bournemouth Corporation	2,000	2,163	2,174	2,048		1,594	2,057	1,923	3,006		4	8,581	– 441
Bradford Corporation	5,657	7,521	6,475	5,849		6,152	6,400	6,329	6,296		3	20,627	– 2,142
Brighton Corporation	991	1,060	945	901		938	974	910	1,241		3⅞	3,447	– 103
Bristol	8,584	10,520	9,957	8,957		8,845	9,671	9,755	9,305		16	146,564	+ 7,339
Burnley Corporation	1,699	1,733	1,541	1,465		1,571	1,665	1,602	2,113		4	6,951	+ 513
Burton-on-Trent Corporation	265	299	267	262		227	228	240	269		3	799	– 122
Bury Corporation	980	1,447	1,329	1,242		586	1,308	1,272	1,730		3⅝	4,897	– 102
Cardiff Corporation	1,140	2,851	2,438	2,426		545	2,711	2,814	2,693		3	8,763	– 92
Chatham and District	1,037	1,329	1,081	1,156		1,031	1,114	1,139	1,132		16	16,703	+ 546
Chesterfield Corporation	206	334	251	251		281	243	259	272		3	774	– 15
Colne Corporation	262	272	259	225		294	270	242	368		—	—	—
Cork Electric	429	513	481	484		433	468	465	471		16	7,134	+ 2
Croydon Corporation	...	550	1,670	1,669		...	1,796	1,259	958		3	4,013	– 342
Derby Corporation	967	1,158	959	945		1,035	1,071	1,046	1,139		3½	3,488	– 125
Dover Corporation	172	299	273	269		210	280	277	305		3	913	– 87
Dublin and Lucan	154	200	127	139		113	129	130	135		16	1,859	– 164
Dublin United	5,652	6,960	6,326	6,101		5,856	6,083	5,988	...		15	87,417	+ 3,402
Dundee City	1,212	1,294	1,346	1,289		1,240	1,354	1,325	1,262		48½	65,557	+ 3,621
East Ham Corporation	1,279	1,409	1,291	1,309		1,168	1,214	1,231	1,271		3½	3,934	– 264
Exeter Corporation	304	414	328	330		319	353	342	339		3	1,036	– 134
Gearless Motor 'Buses	*	...	...	...		...	...	...	...		—	—	—
Glasgow Corporation	20,438	21,028	21,206	21,560		21,610	22,303	22,533	22,422		47	1,019,880	+ 74,680
Glasgow Subway	1,053	1,046	1,068	1,106		1,219	1,221	1,247	1,222		16	19,978	+ 2,470
Glossop (Urban Elec. Supply Co.)	120	131	116	115		128	135	124	150		17	2,195	+ 322
Halifax Corporation	1,908	2,537	2,006	1,984		1,854	1,392	2,023	1,915		2½	5,329	– 1,197
Halifax Corp. Motor Omnibuses	38	61	45	42		35	30	36	36		2½	103	– 46
Hastings and District	746	1,074	915	932		705	836	783	911		16	11,818	+ 425
Huddersfield Corporation	2,334	3,386	2,387	2,353		2,646	2,778	2,664	2,708		3	8,151	+ 25
Hull Corporation	3,033	3,289	2,982	2,981		2,949	2,948	3,058	3,169		3	9,687	– 1,038
Ilford U.D. Council	...	702	588	606		...	650	644	659		3	2,085	+ 98
Ilkeston Corporation	...	137	115	115		...	125	122	122		3	370	+ 2
Ipswich Corporation	424	504	399	407		478	454	420	493		3	1,454	+ 48
Isle of Thanet	323	213	326	339		244	257	245	310		29	7,336	– 1,409
Kilmarnock Corporation	155	167	162	161		156	157	165	170		49	8,133	+ 320
Lanarkshire	1,706	1,866	1,833	1,944		1,892	2,262	2,106	2,214		16	33,808	+ 5,548
Lancashire United	1,440	2,094	1,567	1,631		1,535	1,748	1,648	1,608		16	25,284	+ 783
Leeds City	8,023	9,873	8,098	8,254		8,796	9,335	8,992	9,017		4	29,498	+ 2,161
Leicester Corporation	2,888	3,217	2,801	2,814		3,172	3,259	3,200	3,231		16	51,496	+ 6,153
Leith Corporation	661	718	677	676		764	893	798	786		49	37,700	+ 3,494
Leyton U.D. Council	1,497	1,936	1,544	1,594		1,432	1,554	1,536	1,505		3	4,595	– 478
Liverpool Corporation	12,171	13,772	12,562	12,850		13,021	13,665	13,443	13,567		16½	213,137	+ 10,043
Llandudno and Colwyn Bay	290	473	323	326		196	217	236	298		20½	4,004	– 425
London County Council	46,463	37,872	47,777	48,996		44,069	33,560	...	...		51⅔	2,299,705	– 27,382
London General Omnibus	*	...	...	...		...	...	...	...		—	—	—
London United	*	...	...	...		...	...	...	...		—	—	—
Lowestoft Corporation	167	189	166	159		115	122	124	133		28½	4,828	– 1,134
Maidstone Corporation	131	390	188	196		166	317	189	186		3	692	– 82
Manchester Corporation	16,182	18,567	16,869	17,566		17,472	18,239	17,670	18,091		3	57,713	+ 2,938
Metropolitan Electric Tramways	*	...	...	...		...	...	...	...		—	—	—
National Steam Car	*	...	...	...		...	...	...	...		—	—	—
Nelson Corporation	137	214	155	169		83	203	182	269		3½	737	+ 62
Newcastle-on-Tyne Corporation	5,888	6,132	5,995	5,821		5,946	5,892	5,981	6,111		3	19,268	– 1,648
Newport (Mon.) Corporation	739	871	760	736		836	860	876	865		3	2,806	+ 782
New St. Helens and District	874	1,278	890	950		814	940	904	854		42	41,485	+ 2,910
Northampton Corporation	487	964	633	626		527	584	600	656		3	1,840	– 383
Nottingham Corporation	3,047	4,388	3,424	3,363		4,426	3,306	3,698	3,738		3	10,737	– 438
Oldham Corporation	2,157	2,513	2,137	2,122		2,416	2,298	2,214	2,760		4	10,421	+ 283
Portsmouth Corporation	2,183	2,697	2,455	2,408		2,232	2,515	2,452	2,515		4	7,914	—
Preston Corporation	796	1,037	856	896		1,213	748	964	1,005		2⅞	2,718	– 71
Provincial	2,039	2,494	2,147	2,085		2,112	2,329	2,171	2,318		29½	60,086	+ 3,397
Reading Corporation	676	799	722	691		752	784	757	767		2⅝	2,204	+ 67
Rhondda Tramways	1,088	1,513	1,238	1,110		868	1,242	1,195	1,206		16	18,429	+ 582
Rochdale Corporation	1,686	1,911	1,541	1,539		1,600	1,757	1,637	2,210		3½	6,082	+ 88
Rotherham Corporation	1,018	997	976	978		1,031	1,299	1,314	1,697		3⅝	5,342	+ 1,371
Salford Corporation	4,596	4,856	4,840	4,959		5,527	5,193	5,011	5,665		3⅝	18,472	+ 903
Sheffield Corporation	8,117	8,986	8,226	8,034		9,936	9,802	9,733	10,004		4	40,408	+ 5,968
Southampton Corporation	1,176	1,479	1,297	1,362		1,443	1,505	1,439	1,391		2⅝	3,900	– 236
Southend-on-Sea Corporation	643	1,077	754	748		599	640	648	639		3	1,765	– 337
South Metropolitan Tramways	*	...	...	...		...	...	...	...		—	—	—
South Shields Corporation	772	830	691	697		742	714	754	824		3½	2,462	+ 77
Sunderland Corporation	...	1,531	1,357	1,351		...	1,617	1,507	1,578		3	5,143	+ 17
Sunderland District	535	770	559	569		597	630	548	576		25	14,080	+ 828
Swindon Corporation	161	152	180	174		177	136	178	169		2⅝	482	– 24
Torquay Tramways	421	775	587	563		411	496	495	489		16	6,731	– 351
Tramways (M.E.T.) Omnibus Co.	*	...	...	...		...	...	...	...		—	—	—
Tyneside Tramways and Tramroads	514	655	549	547		507	560	532	515		16	7,888	– 344
Wallasey Corporation	1,057	1,383	1,117	1,124		1,129	1,216	1,174	1,295		3½	3,910	– 230
Walsall Corporation	656	863	633	653		742	790	776	788		17	12,522	+ 1,570
Walthamstow U.D. Council	642	1,043	778	816		622	987	942	975		3	3,088	+ 318
Warrington Corporation	430	454	424	413		464	465	474	508		3	1,386	+ 142
West Ham Corporation	2,925	3,394	2,898	3,012		2,919	3,126	3,097	3,148		2⅝	8,937	+ 84
Wigan Corporation	1,438	1,653	1,407	1,462		1,509	1,603	1,574	1,626		3	4,574	– 205
Wolverhampton Corporation	1,293	979	996	983		1,180	1,107	1,105	1,582		4	4,696	+ 671
Yorkshire (West Riding)	1,508	1,844	1,443	1,796		1,755	1,629	1,557	1,764		17	27,122	+ 2,126

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officals and the principal particulars relating to each undertaking.

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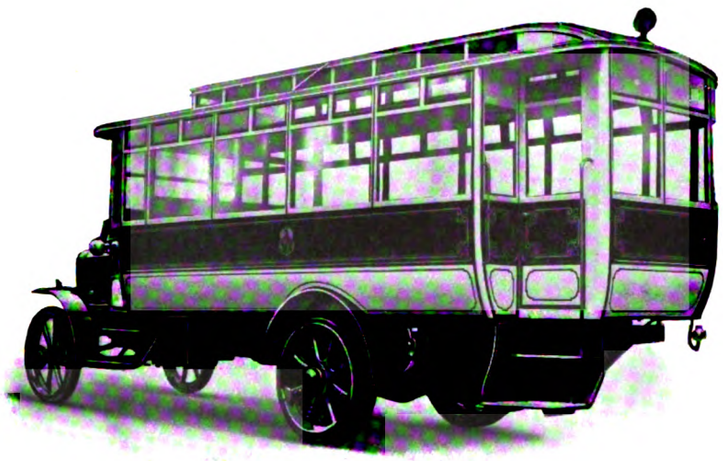

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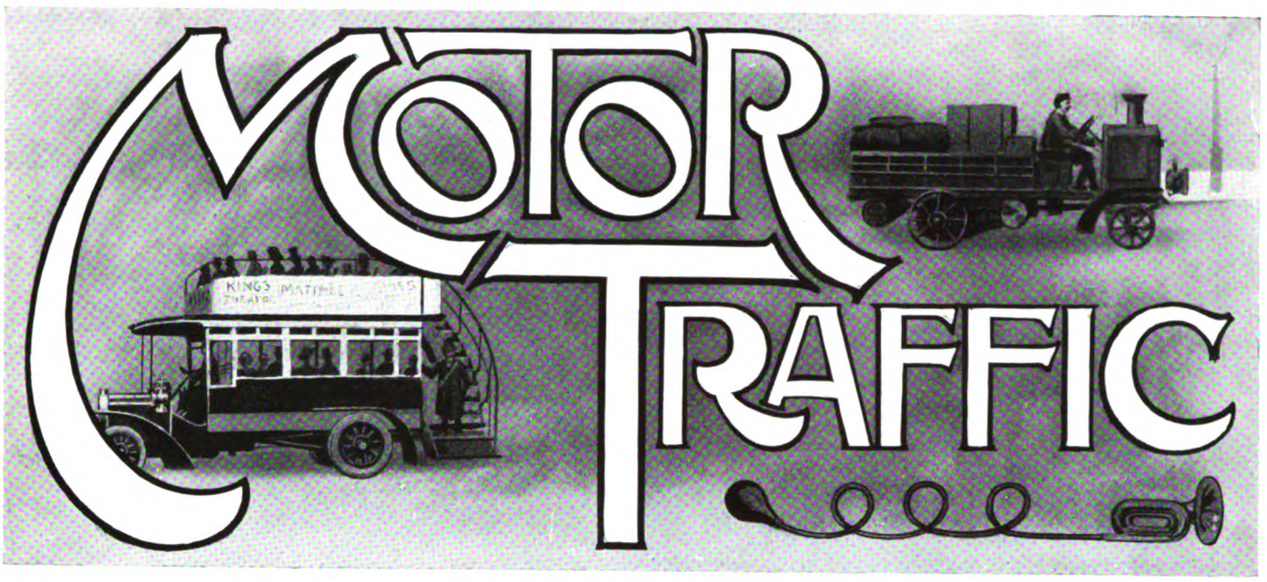

The question of how to get the fullest possible results from the use of motor transport is one of outstanding importance in view of the ever-increasing cost of fuel, whether it be coal or spirit, and of other necessaries, and the difficulties of securing suitable drivers. There is little doubt that, so far as individual effort and organisation can achieve this end, practically all that can be done is being done by owners and users of vehicles to-day, if only because circumstances have proved too strong to be resisted. If this statement be subject to any exception at all, it must be in regard to municipal vehicles as to which certain inherent conditions—which have lately been discussed to some extent in these columns—make it virtually impossible for the fullest measure of economy in operation to be obtained. It has been pointed out that it is the exception and not the rule for municipal motor vehicles to be under separate and expert control. Their purchase and upkeep are almost invariably left to departmental committees and officials, working in more or less watertight compartments. The result therefore is that municipalities tend to acquire, not homogeneous "fleets" of vehicles, but a number of small groups, each kept entirely detached one from the other, and never or rarely being interchanged. This practice is so widespread, and its wastefulness so palpable, that little or no apology is demanded for returning for a moment to the subject. Economy in the use of motor transport cannot, however, be dismissed as a matter of operating organisation alone; it is very largely also one of the purchase at the outset of the right kind of vehicle. This may possibly appear to be a somewhat elementary desideratum, but it is one of which sight is lost with more frequency than might generally be believed. To a large extent this may be due to the tendency towards standardisation in bodywork as well as chassis, which results in a trader buying a vehicle of more or less stereotyped design. This may at first sight seem to make for economy; but on investigation it will be found to have the reverse effect, inasmuch as the requirements of individual users vary to such degree that it is impossible that they can properly be met by standardised types of vehicles, no matter how skilfully they may strike a general average. To obtain the maximum service, and therefore the utmost degree of economy, it is essential that the needs of each individual purchaser should receive due attention in the type and design (shape and size of body, etc.) of the van or lorry to be supplied, and although this may perhaps result in extra expenditure being incurred in the first instance, it will prove by far the more economical plan in the long run.

* * * * * *

In municipal work the adaptability that results from having interchangeable or convertible bodies is peculiarly desirable. Except in the case of the lighter types of vans and special vehicles, there is no reason whatever why all conveyances ordered by public authorities should not, as a matter of course, be convertible to various uses. In many towns and localities this necessity is realised, but it is by no means universally the case, and upon this fact the lack of that centralised control of municipal motor fleets has considerable bearing. As a case in point, one may take a Corporation gas works, requiring a lorry for carting coal. If, as is usual, the department is left to deal with the matter independently, the probability, if not certainty, will be that they will order a vehicle of, say, 3½ tons capacity, with an ordinary open body—a lorry quite suitable for carting coal, or similar service, but nothing more. A general manager—in towns where there are tramways he would naturally be the tramway manager—having charge and control of all vehicles, and the duty of giving his employers the best possible transport service at the minimum cost, would take a wider survey. He would bear in mind the other departments—works, cleansing, and so forth—and he would aim at procuring a lorry such as would be capable of rendering assistance all round, and he would see that each of his chassis were so equipped as to be ready at all times to meet any reasonable demand from whatever quarter. Hence the value of adaptability in municipal vehicles. Thus that coal lorry would at least be provided with tipping gear. Nor is there any reason why, by specifying removable sides and end, an open platform should not be made available for cases of need, so that loads of bricks, or large blocks of stone for the works department, or loose ballast and tar barrels for the road surveyor, could be dealt with. Or, perhaps, instead of tipping mechanism being fitted, the body might be made interchangeable with a tank and sprinkler, thus achieving a double or treble purpose in another way. It is perfectly true that this latter arrangement is in o wise unknown, but the possibilities of convertible and interchangeable bodies have not been utilised to anything like the extent that might reasonably have been expected. It is obviously unsound policy to buy two chassis where one might suffice, but this error has been committed in the past to no small extent.

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MOTOR TRAFFIC.

The clause contained in the Local Government (Emergency Provisions) Bill, empowering local authorities to restrict motor omnibus and similar traffic over new routes, establishes a somewhat notable precedent, despite the fact that for the momen it forms part of a mere emergency measure. We deal elsewhere in this issue with the danger to be apprehended from the proposal to leave the settlement in the hands of the local authority. The much-vexed question of heavy motor traffic on the roads can hardly be said to have been rendered any easier of solution by the effects of the war. The wear and tear upon the highways by military traffic has been so very heavy that it is to be feared that the task of putting matters right will be long and arduous and exceedingly costly. In these circumstances, the temptation to mulct the users of heavy motor vehicles with some contribution towards the outlay is bound to assert itself, and on the whole it would be as well for those concerned to be prepared for any eventualities. The clause in the Bill just referred to, however, does not deal with this point. What it actually effects is to prohibit the opening up of new routes by motor omnibuses or other public passenger vehicles, except with the consent of the local authority or the Local Government Board. Ordinary commercial or trade vehicles will not in any case be touched, whilst, so far as the class of traffic specified is involved, it would seem that a safeguard in the shape of an appeal to he Local Government Board, is provided in case of palpably unreasonable refusal of consent by a local body to a new service that might be the means of affording valuable facilities to the public. It must, however, in candour be said that there has been no little cause for complaint in a contrary sense.

RESTRAINT OF MOTOR PASSENGER SERVICES.

In the House of Lords, on April 18, the Earl of Northbrook, on the consideration of the Local Government (Emergency Provisions) Bill, said :—The object of the clause standing in my name on the paper is to enable local authorities to effect economy during the war in the maintenance and repair of roads, or, at any rate, to prevent for the time being an unnecessary additional amount of traffic being put on their roads, with a consequent increase of expenditure. Your lordships are aware that the annual cost in respect of main roads has, since the introduction of mechanically-propelled vehicles, greatly increased, and is now the largest charge on the general purposes account of County Councils. It is at present open to any individual or private company, without the consent of the local authorities, to run omnibuses or other similar carriages plying for hire over the roads, for the repair and maintenance of which the local authorities are liable. This practice has widely extended, is increasing, and has increased since the war. I have a list of 30 counties in England and Wales in which motor and other omnibuses are running. This heavy traffic puts a heavy charge upon the county ratepayers, while the owners of the omnibuses contribute little, and in many cases nothing, to maintenance of the roads. That is a question for future consideration. The clause which I am moving is an emergency measure, and its operation would continue only during the war or for such period not exceeding one year after, as the Local Government Board might fix. The clause does not propose to interfere with existing omnibus routes. I move to insert, after Clause 19, the following new clause :—

(1) Notwithstanding anything in any statute it shall not be lawful after the passing of this Act for any omnibus to ply for hire on or use any route which has not been regularly used by omnibuses plying for hire within 12 months prior to the first day of March, 1916, except with the consent of the highway authority or, if more than one, every highway authority liable for the maintenance and repair of the highways along which the route runs, which consent may be given on such conditions as the highway authority may consider fit, or, if such consent is unreasonably refused, without the consent of the Local Government Board ; and if any person drives an omnibus or allows an omnibus to be driven along any route in contravention of this provision, he shall, on summary conviction, be liable to a fine not exceeding £5 and to a further penalty not exceeding 40s. for every mile travelled by every omnibus in contravention of the provisions of this section, all penalties recoverable under this section to be paid into the funds of the highway authority concerned.

Provided that nothing in this section shall apply where a route is altered in consequence of the temporary diversion of traffic on account of the breaking up of any road or in pursuance of the directions of any police authority or other directions lawfully given.

Provided also that nothing in this section shall apply to any omnibus plying for hire on any route in any case where the Admiralty, Army Council, or Minister of Munitions are of opinion that an omnibus service is necessary for and is to be used solely by munition workers or other persons engaged on Government war service.

(2) This section shall not be deemed to detract from any existing powers of highway authorities in regard to omnibuses.

(3) For the purposes of this section the expression "omnibus" includes every omnibus, chars-a-banc, wagonette, brake, stage coach, or other carriage plying for hire or used to carry passengers at separate fares.

Lord HYLTON : The Government are willing to accept this clause. The safeguard that the clause contains, requiring the sanction of the Local Government Board, will probably guarantee that no unreasonable restrictions will be permitted.

The amendment was agreed to.

AMENDMENTS BY THE HOUSE OF COMMONS.

The House of Commons on May 2 considered the Lords' amendments. On a new clause, as set forth above, Sir F. BANBURY (City of London) asked whether the clause was in order.

The SPEAKER said that he would not dare to rule the House of Lords out of order.

Mr. JOYNSON HICKS (Brentford) moved to substitute two years for 12 months in the clause. He said that there was a Committee now sitting on the question of heavy motor regulations, and another one was to be set up to consider the whole question of roads. A large number of omnibuses had been taken off the roads to be used on war service in France. The object of his first amendment was to put things back to the pre-war basis. His second and third amendments were to give an appeal to the Local Government Board in the case of unfair conditions being imposed. His fourth amendment was to meet the case where munition workers were conveyed by omnibuses not plying for hire.

Mr. HAYES FISHER (Parliamentary Secretary, Local Government Board) said that the clause was supported by the County Councils. The Local Government Board had no objection to it. This was an emergency Bill, which would last only for one year after the war. Highway authorities had been very heavily hit by the road traffic ; grants could now be obtained from the Road Board. The highway authorities were naturally seeking to limit the user of the roads to a certain extent, and it was proposed that no omnibus company should ply for hire on any new routes, but they would be allowed to use routes on which they had plied for 12 months, or for two years if the present amendment were accepted. He proposed to accept all the amendments of Mr. Joynson Hicks.

Mr. DENNISS (Oldham) objected to the clause on the ground that it endeavoured to establish the principle of local veto over traffic. If there was to be a veto it should be given to the Local Government Board. The fact that we were superior to the rest of the world in heavy motor traffic was because that trade had not been fettered by the local authorities, as light motor traffic and tramways had been by the State and local authorities.

Mr. Joynson Hicks' amendments to the clause were agreed to, and the clause as amended was approved.

DAIMLER OMNIBUSES FOR BIRMINGHAM AND WALSALL.

On the following page are reproduced photographs of one of the eighteen 40-H.P. Daimler omnibuses ordered by Birmingham Corporation Tramways Department and one of nine single-deck Daimlers for which the Walsall Tramways Committee have placed an order.

The popularity of the single-deck omnibus is steadily increasing, especially in districts where low railway bridges render the roads impassable for double-deck conveyances. Their appearance is more pleasing than is the case with the chassis fitted with a double-deck body, though of course they do not offer the fresh air and sight-seeing attractions of the latter. The single-deck body, however, is very roomy, and accommodates more passengers than is the case with the saloon of the double-deck machine.

Other particulars are as follow : –

	Birmingham.	Walsall.
Height over all ...	13 ft. 1 in.	10 ft. 7 in.
Length ,, ,, ...	24 ft. 2½ in.	24 ft. 11½ in.
Width ,, ,, ...	6 ft. 11 in.	7 ft. 2 in.
,, internal ...	6 ft. 1 in.	6 ft. 9 in.
Passengers outside	18 and 2	2
,, inside	15	26
,, total...	35	28

An "Allen" type body is fitted to the Birmingham omnibus. The seating accommodation in the interior is by half-length longitudinal seats in the rear, and cross-section seats forward.

As motor manufacturers "controlled" by the Ministry of Munitions are only able to supply commercial vehicles to firms engaged in Government work, special permission had to be obtained before the Birmingham and Walsall Corporation orders could be executed.

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MOTOR TRAFFIC.

One of Nine 40-h.p. Daimlers for Walsall Tramways Department.

First of Eighteen Daimlers with "Allen" Bodies Ordered by Birmingham Corporation.

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MOTOR TRAFFIC.

ROAD TRACTION BY PETROL, STEAM AND ELECTRIC VEHICLES.

A paper bearing the above title was read by Mr. G. Martin Gamble at a meeting of the Yorkshire Association of Students of the Institution of Civil Engineers at the Cutlers' Hall, Sheffield. Mr. Gamble observed that the transport difficulties resulting from the war made the consideration of the value of the different forms of traction important. Motors would serve a radius of thirty or forty miles per day, as compared with twelve miles for horse haulage. there would be ample supply of petrol for motor purposes at a maximum price of 1s. a gallon.

The elimination of the boiler in a petrol machine did away with the depreciation of this part, and saved the time occupied in cleaning and repairing. Again, a petrol machine was always available for service at short notice, whilst with steam wagons at least one hour was taken up in raising steam, half an hour at night in withdrawing or banking fires, and half an hour in replenishing water tank. This loss was equivalent to fifty ten-hour days per annum. Another item of economy possessed by the petrol vehicle was that it could be stopped during long waits without loss of fuel.

ESTIMATED RUNNING COSTS. STEAM AND PETROL VEHICLES.

	Petrol wagons. Rubber tires.								Tractor.		Steam wagon. Steel tires.		Steam wagons. Rubber tires.			
Net load capacity	2 tons.		3 tons.		4 tons.		5 tons.		5 tons.		10 tons with trailer.		3 tons.		5 tons.	
Cost—	£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.	
Chassis without tires	525 0 0		610 0 0		700 0 0		750 0 0		550 0 0		550 0 0		500 0 0		550 0 0	
Tires guaranteed for 10,000 miles	40 0 0		55 0 0		60 0 0		65 0 0		—		—		65 0 0		100 0 0	
Body and equipment	35 0 0		40 0 0		45 0 0		50 0 0		—		45 0 0		40 0 0		50 0 0	
Trailer and equipment	—		—		—		—		70 0 0		55 0 0		—		—	
Total	600 0 0		705 0 0		805 0 0		865 0 0		620 0 0		650 0 0		605 0 0		700 0 0	
Mileage—																
Per day	'40	90	40	90	40	90	40	90	20	30	25	35	35	55	30	50
Per week of five working days	200	450	200	450	200	450	200	450	100	150	125	175	175	275	150	250
Per annum of fifty working weeks	10,000	22,500	10,000	22,500	10,000	22,500	10,000	22,500	5,000	7,500	6,250	8,750	8,750	13,750	7,500	12,500
Standing charges—	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Interest at 5 per cent. per annum	30 0 0	30 0 0	35 0 0	35 0 0	40 5 0	40 5 0	43 5 0	43 5 0	31 0 0	31 0 0	32 10 0	32 10 0	30 5 0	30 5 0	35 0 0	35 0 0
Depreciation on vehicle, less tires	84 0 0	84 0 0	97 10 0	97 10 0	111 15 0	111 15 0	120 0 0	120 0 0	62 0 0	62 0 0	81 5 0	81 5 0	54 0 0	67 10 0	60 0 0	75 0 0
Insurance	15 0 0	15 0 0	18 0 0	18 0 0	21 0 0	21 0 0	22 0 0	22 0 0	16 0 0	16 0 0	17 0 0	17 0 0	15 0 0	15 0 0	17 0 0	17 0 0
Running charges—																
Wages of driver at 35s. and 45s. per week	91 0 0	117 0 0	91 0 0	117 0 0	91 0 0	117 0 0	91 0 0	117 0 0	91 0 0	91 0 0	91 0 0	117 0 0	91 0 0	117 0 0	91 0 0	117 0 0
Wages of assistant at 24s. and 28s. per week and 26s.	—	—	—	—	—	—	—	—	—	—	62 8 0	72 6 0	62 8 0	67 12 0	62 8 0	67 12 0
Fuel (petrol at 1s. 6d. per gal., coke at 1s. per cwt.)	75 0 0	168 15 0	88 5 0	198 10 0	107 5 0	241 0 0	125 0 0	281 5 0	33 10 0	50 4 0	50 4 0	70 6 0	39 1 0	61 7 0	43 10 0	72 11 0
Rubber tires	40 0 0	90 0 0	55 0 0	123 15 0	60 0 0	135 0 0	65 0 0	146 5 0	—	—	—	—	56 17 0	89 7 0	75 0 0	125 0 0
Maintenance and repairs	25 0 0	50 0 0	30 0 0	60 0 0	40 0 0	80 0 0	50 0 0	100 0 0	28 0 0	42 0 0	42 0 0	59 0 0	25 0 0	40 0 0	35 0 0	60 0 0
Lubricants and sundries	8 0 0	17 5 0	10 0 0	22 0 0	15 15 0	35 0 0	20 15 0	45 5 0	10 10 0	14 16 0	15 13 0	21 13 0	15 9 0	22 19 0	17 2 0	27 17 0
Total annual cost	368 0 0	572 0 0	425 0 0	672 0 0	487 0 0	781 0 0	537 0 0	875 0 0	272 0 0	307 0 0	392 0 0	471 0 0	389 0 0	511 0 0	436 0 0	597 0 0
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
Cost per mile run (approximate)	8.7	6	11.2	7.2	11.7	8.3	12.8	9.3	13.5	9.8	15	12.9	10.6	8.9	13.9	11.4
Cost per ton-mile—																
Loaded both ways with full load	4.3	3	3.7	2.4	3	2	2.5	1.8	2.7	1.9	1.5	1.2	3.5	2.9	2.8	2.3
Loaded one way only with full load	7.8	5.4	6.8	4.4	5.4	3.6	4.5	3.3	4.9	3.6	2.7	2.3	6.3	5.4	5.1	4.2
Depreciation, per cent. per annum	15	15	15	15	15	15	15	15	10	10	12½	12½	10	12½	10	12½
Estimated fuel consumption, miles per gal. lb. per mile	10 m.p.g.	10 m.p.g.	8½ m.p.g.	8½ m.p.g.	7 m.p.g.	7 m.p.g.	6 m.p.g.	6 m.p.g.	15 lb. per mile		18 lb. per mile		10 lb. per mile		13 lb. per mile	

NOTE.—The cost per ton-mile loaded one way only is approximately 10 per cent. less than double the cost loaded both ways, as there is less wear and tear on tires and less fuel used when running empty. Management and establishment charges are not included in the above figures.

ELECTRIC VEHICLES.

	Author's estimate.						Mossay and Co.'s estimate.			Wolseley Motor's estimate.						Edipon Accumulator's estimate.						
Net load capacity	2 tons.		3½ tons.		5 tons.		1½ tons.			2 tons.		3½ tons.		5 tons.		2 tons.		3½ tons.		5 tons.		
Cost—	£ s. d.		£ s. d.		£ s. d.																	
Chassis, less battery and tires	465 0 0		620 0 0		635 0 0					—		—		—		—		—		—		
Battery (approximate)	165 0 0		185 0 0		240 0 0					—		—		—		—		—		—		
Tires, guaranteed 10,000 miles	35 0 0		50 0 0		65 0 0					—		—		—		—		—		—		
Body and equipment	35 0 0		40 0 0		50 0 0					—		—		—		—		—		—		
Total	700 0 0		895 0 0		990 0 0					—		—		—		—		—		—		
Mileage—																						
Per day	30	50	25	45	20	35	—	—	—	40		40		35		50		45		40		
Per week of five working days	150	250	125	225	100	175	—	—	—	—		—		—		300		270		240		
Per annum of fifty working weeks	7,500	12,500	6,250	11,250	5,000	8,750	6,000	8,000	12,000	—		—		—		—		—		—		
Cost basis	Per annum.						Per annum.			Per week.	Per mile.	Per week.	Per mile.	Per week.	Per mile.	Per week.	Per mile.	Per week.	Per mile.	Per week.	Per mile.	
Standing charges—	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.	£ s. d.	d.	£ s. d.	d.	£ s. d.	d.	£ s. d.	d.	£ s. d.	d.	
Interest at 5 per cent. per ann	35 0 0	35 0 0	44 15 0	44 15 0	40 10 0	49 10 0	14 10 0	14 10 0	14 10 0	—	—	—	—	—	—	—	—	—	—	—	—	
Depreciation at 10 per cent. on vehicle, less battery and tires	50 0 0	50 0 0	66 0 0	66 0 0	68 10 0	68 10 0	50 0 0	50 0 0	50 0 0	0 18 7	.93	1 2 0	1.14	1 6 3	1.506	1 12 9	1.32	1 19 8	1.76	2 4 9	2.23	
Insurance	12 0 0	12 0 0	13 0 0	13 0 0	14 0 0	14 0 0	20 0 0	20 0 0	20 0 0	0 6 5	.32	0 7 7	.38	0 8 0	.46	0 4 0	.16	0 4 0	.18	0 4 0	.2	
Running charges—																						
Wages of driver	83 4 0	83 4 0	83 4 0	83 4 0	83 4 0	83 4 0	78 0 0	78 0 0	78 0 0	1 8 0	1.4	1 8 0	1.4	1 8 0	1.6	1 10 0	1.2	1 10 0	1.33	1 10 0	1.5	
Energy at 1d. per unit	28 2 6	46 18 0	31 5 0	56 5 0	33 7 0	58 6 0	20 0 0	26 10 0	40 0 0	0 10 0	.5	0 13 4	.67	0 13 1	.75	1 10 0	1.2	1 18 6	1.71	2 8 0	2.4	
Maintenance of battery	61 17 6	103 2 0	57 6 0	103 2 0	60 0 0	105 0 0	45 0 0	60 0 0	75 0 0	1 2 7	1.13	1 9 3	1.46	1 17 6	2.14	0 4 1	.16	0 5 5	.24	0 6 7	.33	
Maintenance of chassis and body	18 15 0	31 15 0	24 15 0	45 0 0	26 0 0	45 10 0	16 5 0	21 15 0	32 10 0	0 12 0	.6	0 16 0	.8	0 14 0	.8	0 12 2	.59	0 13 4	.67			
Tires	26 5 0	43 15 0	31 5 0	56 5 0	32 10 0	40 12 0	20 0 0	25 10 0	40 0 0	0 17 7	.88	1 5 7	1.28	2 7 5	2.26	0 16 1	.64	0 19 9	.88	1 2 4	1.12	
Lubricants and sundries	2 16 0	4 6 0	3 10 0	5 9 0	3 19 0	6 8 0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Total cost	318 0 0	410 0 0	355 0 0	473 0 0	371 0 0	471 0 0	265 15 0	296 5 0	360 0 0	5 15 2	5.76	7 2 6	7.13	8 14 3	9.516	0 9 1	5.17	7 10 7	6.69	8 9 0	8.45	
	d.	d.	d.	d.	d.	d.	d.	d.	d.													
Cost per mile run (approx.)	10.1	7.8	13.6	10	17.8	12.8	10.5	8.8	7													
Cost per ton-mile—																						
Loaded both ways	5	3.9	3.9	2.8	3.5	2.5	—	—	—													
Loaded one way only	7.6	5.8	5.8	3.3	5.3	3.8	—	—	—													
Estimated current consumption per mile	.9 units		1.2 units		1.5 units		—	—	—													
Estimated battery upkeep per mile	1.98d.		2.2d.		2.88d.		—	—	—													

NOTE.—The cost per ton-mile loaded one way only is approximately 26 per cent. less than double the cost loaded both ways, as there is less wear and tear on tires and current consumption proportionately less. Management and establishment charges are not included in the above figures.

For short distances there would be two handlings of the load by motor as against four or more by rail; there would be greater safety in transport, no terminal delays, the goods would always be under the care of the owners or their men, and frequently two removals could be made by motor while one was being effected by rail, which would make up for the higher cost in transport by the former.

Steam lorries were described as being preferable to tractors in towns, whereas the tractor was of most value when working in soft or unmade ground. Dealing with the criticism of motor vehicles on the ground of the dearness of petrol, it was pointed out that the price of coal had also gone up. It was believed that after the war

Electric battery vehicles had lately come into somewhat extensive use, and for town use or suburban delivery work they gave promise of meeting an undoubted demand for economy and operation compared with horse traction, and in some cases with other forms of mechanical traction.

To secure the highest efficiency it was not sufficient to scrap the horses and put a motor to work on precisely the same lines. The influences of higher speed and load factors demanded that due care and thought be given to the possibilities of reducing the number of stops and unnecessary delays in loading and unloading, etc. Careful consideration of the routing of vehicles where possible to avoid

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traversing the same ground empty, unnecessarily, and the provision of special or interchangeable bodies, combined with adequate facilities for rapid loading and unloading, would well repay any time or money spent on the subject. Careful driving at reasonable speeds, combined with thorough daily inspection and prompt renewals of worn parts, would give a handsome return in reliability and economical operation.

Running costs in pence per mile, unless accompanied with details as to how they were arrived at, were liable to be misleading. The estimates shown in the accompanying tables were purposely made out in detail so that any particular item could be varied to suit some other circumstances. These figures could only be taken as general indications, for seldom were two cases precisely alike. Two columns for various mileages per day were given for each size of vehicle, these mileages representing approximately the limits of a normal day's run, the lower figures being in the neighbourhood of the minimum mileage at which it paid to run the vehicle under average circumstances. The allowances provided under the various headings were upon rather more generous lines than was usual in manufacturers' catalogues, and were based upon present-day costs, allowing for the advance in prices of vehicles and materials due to the war.

Establishment charges were not provided for in the figures given, as these varied considerably, depending upon whether the vehicle was a single lorry in a large undertaking, or whether it was the sole stock-in-trade of a haulage contractor. In the former case, the motor costs would form a very small fraction of the establishment charges, whereas in the latter they bore a very much higher ratio. It was largely on this account that haulage contractors had to charge much higher rates for hire than the figures shown in the tables on page 374.

In the discussion following the reading of the paper, Mr. W. J. Hadfield, city surveyor of Sheffield, said his experience was that a 5-ton petrol machine would save £200 per annum as compared with horse haulage when the work was fairly regular.

BRITISH MAGNETOS.

Two Requests by the Manufacturers.

The manufacture of magnetos is dealt with in the recently issued report of the Sub-Committee of the Advisory Committee to the Board of Trade in respect to measures for securing after the war the position of certain branches of British industry. In 1913 the imports of magnetos were estimated at £500,000. The report observes that prior to the war the trade in magnetos was virtually monopolised by the Bosch Company, Stuttgart, and at the outbreak of the war there were no manufacturers in this country, where the normal demand was about 5,000 magnetos per week. Since then the demand has substantially increased, especially for military and naval use. "A number of British firms," the report states, "took up the manufacture, and, with the assistance of Sheffield in respect of the production of magnet steel, they have succeeded in making magnetos which have passed the Government tests, and are asserted to be as good as the Bosch products. The firms are receiving large Government contracts, and there seems to be no doubt that, in this instance (which is specially important as being one of a "key" industry), a considerable British manufacture could be built up which *inter alia* would guard against a repetition of the serious difficulties caused in the early stages of the war by our dependence on foreign supplies. The one obstacle is the reluctance of the firms concerned to commit themselves to further capital outlay, and the unwillingness of outside capital to come to their assistance, unless assured of some security against the strenuous competition of the Bosch concern after the war.

"The representatives of this industry asked that Government assistance might be afforded them by

"(1) An undertaking that the Government departments concerned in motor tranport and the air services would undertake to make use only of British magnetos made (so far as practicable) only of British parts, such undertaking to be for a term of years after the war ends; and

"(2) The extension to all magnetos of the import duty of 33⅓ per cent. imposed upon magnetos imported as parts.

"We reported to the President of the Board of Trade that, in view of the importance of the manufacture of magnetos for military and naval purposes, its position as a 'key industry,' the efforts which the manufacturers have made, and the undoubtedly severe competition from the powerful Bosch interests which they will have to encounter after the war, we were unanimously of opinion that Government assistance might be given in the two forms desired by the industry."

LONDON OMNIBUS WORKING IN 1915.

The following calculations relating to the receipts and working expenses of the London General Omnibus Company for the year ended December 31, 1915, have been sent to us by a correspondent, who states that they are based upon the company's recently issued report and accounts :—

Gross receipts (traffic, advertising, and sundries)	£2,882,410
Expenditure	£2,412,142
,, percentage of receipts	83·68%
Depreciation for plant, etc., and reserve fund	£198,748
,, percentage of receipts	6·9%
,, ,, capital	6·31%
Total expenses	£2,610,890
,, percentage of receipts	90·58%
Gross balance on working	£271,520
,, ,, percentage of receipts	9·42%
,, ,, ,, capital	8·62%
Interest and balance brought forward	£114,987
Gross available balance	£386,507
,, ,, percentage of receipts	13·41%
,, ,, ,, capital	12·27%
Disposal of Balance :—	
Interest on stock and other expenses	£141,413
Percentage of receipts	4·91%
,, balance	36·59%
,, capital outlay	4·49%
Dividend	£221,856
Percentage of receipts	7·69%
,, balance	57·4%
,, capital outlay	7·04%
Balance carried forward	£23,237
Percentage of gross balance	6·01%
Capital outlay	£3,150,480

	£	Percentage of Total Expenses.	Percentage of Gross Receipts.
Traffic expenses	1,326,781	55·0	46·03
Maintenance	935,451	37·8	32·45
General expenses	149,911	6·21	5·20
Depreciation	23,748	·99	·82
Reserve	175,000	—	6·08
Balance	271,520	—	9·42

The expenses per omnibus mile were stated in our issue of February 6 to have been at the rate of 8¾d., an increase of 1¼d. per omnibus mile compared with the year 1914.

NAPIER MODEL FOR HAULAGE.

Messrs. W. H. Gubb and Sons, of Ilfracombe, are engaged on urgent Government work, and to face the difficulty of railway transport have felt the necessity of an efficient road vehicle. Consequently they recently obtained a 3½-ton Napier business vehicle, which is illustrated above. As will be seen from the illustration, the War Office type body has been used, and by means of a tarpaulin a closed body can be provided.

National Road Congress and Exhibition.—In the course of the report presented at the annual meeting of the County Councils Association, it was stated that although the National Road Congress and Exhibition took place during an abnormal period, the result was satisfactory beyong expectation. The attendances, both at the conference and the exhibition, were very large, 298 local authorities being represented by 881 delegates, including Belgians, while many manufacturers and interested members of the general public were present.

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LIVE AXLES FOR COMMERCIAL VEHICLES.

A paper bearing the above title was recently read before the Institution of Automobile Engineers by Mr. Geo. W. Watson. The author stated that his purpose was to present a *résumé* of up-to-date practice relating to the design of live back axles for commercial vehicles for load capacities of two tons and upwards. He trusted that the paper (extracts from which are given below) might suffice as a basis for discussion with a view to the improvement of so vital a unit in the anatomy of a commercial vehicle. Continuing, he said :—

"Any information that is obtainable in regard to experience with the thousands of vehicles with the Expeditionary Force would appear to show that no small percentage of the troubles experienced has related to back axles. British designers and constructors will be pleased to learn that comparatively few failures have occurred with axles entirely of home design and manufacture.

Duties of a Live Axle.—"A live axle has four important duties to perform ; firstly, it has to carry a large part of the chassis load, plus a still larger part of the weight of the body and the useful load ; secondly, it has to transmit the engine power to the wheel rims and tires ; thirdly, it has to transmit the tractive effort, or push the vehicle along the road ; and fourthly, the containing casing, or forging, has to resist the torque due to the drive ; in some axles this casing has also to resist the braking load.

" The simplest form of live axle is, of course, that used on the majority of steam wagons. This consists, primarily, of a straight shaft of steel running in axle boxes which carry the rear bearing springs ; one of the road wheels is keyed, or otherwise secured to one end of the shaft, whilst the other wheel, freely mounted on the end of the shaft, is driven through a sleeve from a differential gearing. This simple form of live axle, however, has its limitations ; whilst being the cheapest to construct, it does not easily lend itself to any but a single-chain or spur-gear type of drive, and as the main shaft must perform all the three duties named, it follows that the direction of stress in the material will be continually changing all the time the vehicle is running. Consequently, it is neither practicable nor convenient to employ this form of axle for other than comparatively slow moving vehicles.

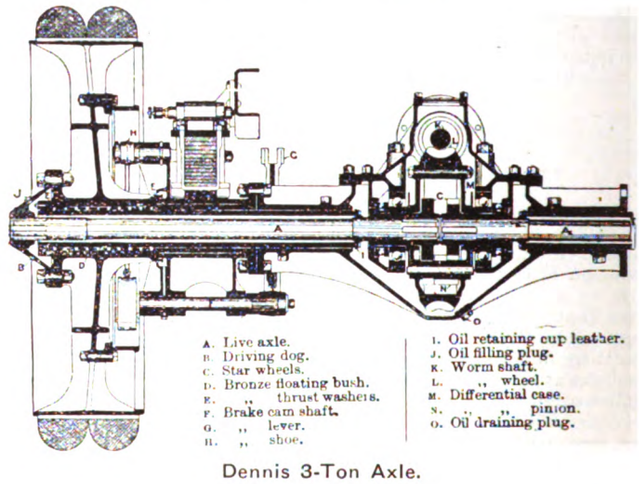
" On the majority of petrol vehicles the type of live axle is such that for the purpose of detailed consideration the complete unit can be divided into two distinct parts : (a) the outer casing, or forging, which carries the imposed load, and may be likened to a beam supported in the hubs of the road wheels and loaded at the two spring flats ; (b) the driving shafts, through which the power is transmitted to the wheels. There is another type used on certain vehicles which are partly or wholly of American origin, of which the Sheldon axle may be taken as an example. In this the casing acts as a housing for all the bearings and gears, while the differential shafts carry the bending stresses due to the load and tractive effort, in addition to the torsional stresses due to the drive, but as the differential gear cage is mounted in bearings within the main casing, the differential shafts are not called upon to take the bending load due to the worm drive. British builders of live axle commercial vehicles generally have adopted the first-named type of axle."

The Solid Forging Axle.—Of the " solid forging " axle the author said he would not venture to assert who was the first to use that type. The Leyland Company, however, had long used one form on their petrol vehicles. A better form of this axle, in his opinion, was the Pagefield. For axles in which the axis of the differential gear was coincident with that of the road wheels, it was convenient to make the axle forging in the shape of a double-shafted banjo, in the manner long used by the Maudslay Company. The general impression was that this company were the first to use this form of axle, but the author recalled that in 1906, or 1907, Thornycrofts showed such a worm-driven axle at Olympia ; that axle was then scoffed at because the load-carrying member, having originally been made for a bevel-driven axle, had been laid on its side and adapted for a worm-drive. What was ridiculed then had become the standard practice with some of our foremost builders of commercial vehicles. This kind of axle when laid upon its side was not in its best position for taking imposed loads, and was liable to excessive deflection under such loads. Although the horizontal disposition of the banjo was not the most favourable so far as imposed vertical loads were concerned, it was not necessarily the worst having regard to all the conditions which have to be met. For instance, the horizontal thrust from a central torque-thrust member, due to the tractive resistance, might conceivably impose a greater bending moment on the axle than that due to the vertical loads. Such conditions would arise whenever the vehicle be driven, with full load, up gradients steeper than 1 in 7.

Built-up Axles.—Adverting to four forms of built-up axles, which were illustrated, the author said that only one could safely be used without a tie bar or truss. With the exception of one, these axles depended to a certain extent for strength and rigidity upon steel tubes which were forced into one part under hydraulic pressure and spigot into the central casing, in this way stiffening up the connection between the respective parts. The necessity for the careful fitting of this tube was long ago impressed upon designers in this country, who had also found that solid drawn or extruded steel tubes for this purpose could not be relied upon. The author understands that the London General Omnibus Company in the " B " type axles make these tubes from solid bars of nickel steel. This axle was illustrated and described in Mr. T. B. Browne's paper on " The London Motor Omnibus Service," read at the summer meeting in the United States in 1913.

Axle Gearing.—Worm-driven axles appeared to be increasing in favour, and probably at least two builders of subsidy vehicles who now employed double-reduction axles would also be using worm drive had the original War Department specification permitted. It had proved to be both a highly efficient and constantly efficient means of power transmission, it was silent in operation, lent itself to a symmetrical design of casing, and—a point which was of great importance—made for a cheaper axle than one produced with double-reduction gears.

For vehicles intended for use on paved or good macadam roads, the author advocated the worm drive for all axles up to 6 tons limit of axle weight, but for heavier and slower-moving vehicles he considered the double-reduction type to be the better, particularly if the differential gear be mounted on the crown wheel shaft and the final drive taken through two pairs of spur gears. If any future



Dennis 3-Ton Axle.

specification issued by the War Office called for increased ground clearance the worm drive might not be acceptable, because it was not practicable to make a worm wheel as small in diameter, for a given gear ratio and load, as might be given to the final gear wheel of a double-reduction axle.

Driving Shafts and Bearings.—Alluding to driving shafts, the author stated that since the adoption of splined shafts, with broached gears and couplings, many old weak spots in axles had disappeared, but many new difficulties, chiefly in connection with the fit of the splines, and the necessary corrections due to distortion during heat treatment, had taken their place. There was great need for a very close interchange of views on these points, and a paper on the subject would no doubt prove of considerable value, and be greatly appreciated by members.

The use of ball or roller bearings on live axles had now become very general, except for the road wheels and differential bearings. For these two purposes there appeared to be ample justification for the retention of plain bearings ; especially did this apply to road wheels, in the hubs of which floating bushes had proved that they were much better suited to the rough usage of commercial service than any tried form of roller or ball bearing. A wheel with floating bushes was easily and quickly replaced in the event of tire damage, and if properly made and fitted such a bush offered very little more friction than a ball-bearing hub of equal load capacity, except when starting from rest.

American constructors were now making great use of Timken taper roller bearings, which were designed to allow of adjustment. It was to be hoped that any member who could speak from personal

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experience extending over two years without replacements would not fail to give his views on the matter.

Lateral Adjustments.—The Tie Bar.—Referring to lateral adjustments, the author observed that no matter how carefully each part of an axle might be machined, some form of end-wise adjustment would be found necessary when an axle was being erected. This arose chiefly from the fact that all dimensions must be taken from the pitch line of the bevel, or worm, gears. Many forms of adjustment had been suggested, but the author was of the opinion that there was but one practical form—the plain mild steel washer of suitable thickness. Such washers might be stocked in about a dozen sizes. Dealing with the tie bar or truss, the paper proceeded :—

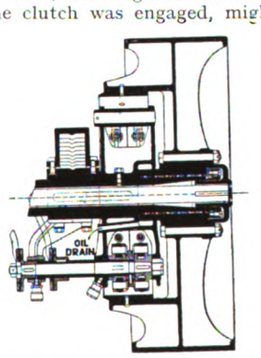
" A tie bar is a source of weakness in a commercial vehicle axle, for the simple reason that it cannot be adjusted to balance the bending moment set up in the axle by the imposed load at more than one point. It is only necessary to picture a vehicle travelling over a very bumpy road, when the axle may momentarily be relieved of the imposed load, to realise what may happen ; the casing may be dangerously stressed in a reverse direction by the tension of the tie rod, or, when the load again rests on the axle, the tie rod itself may suffer as a result of the suddenly increased tension. Generally, and as the present conditions in France have shown, it is the tie rod that gives out first, but injury to the axle frequently follows.

"An axle should be so designed and made that its strength is sufficient without the doubtful and extraneous aid of a tie rod ; that this can be done has been demonstrated by several makers of repute. Considerations of weight, however, as in the case of a London omnibus, more or less force the designer to the use of tie bars, but vehicles with such axles are by no means suitable for country or provincial service where road surfaces may not be so good as in London, unless they carry greatly reduced loads and are run at lower speeds."

Torque and Thrust.—In a reference to torque and thrust the author said that the necessity for some means of transmitting the tractive effort from the axle to the main chassis frame, and for resisting the reaction of the gear drive upon the axle body, or casing, is obvious. There is, however, great diversity of opinion as to the best means of attaining these results.

The triangular method was probably the best arrangement that could be fitted, at any rate for loads of 3 tons and upwards, as it left the joints accessible, and the axle took the thrust load near the spring seats, thus minimising the bending moment on the axle or casing.

The system most favoured by the author was that with one or two parallel torque bars, leaving the thrust to be taken by the springs. It was simple and practical, and ensured a minimum bending moment on the axle ; further, it did not ask too much of the springs. The author had found this arrangement very satisfactory for passenger vehicle work, as it tended to reduced vibration, whilst the upward kick to the frame, resulting from the starting or accelerating effort each time the clutch was engaged, might be reduced to a



Straker-Squire Arrangement of Twin Brakes on Road Wheels.

negligible amount if the torque bars were anchored at a point about 4 ft. forward of the axle centre.

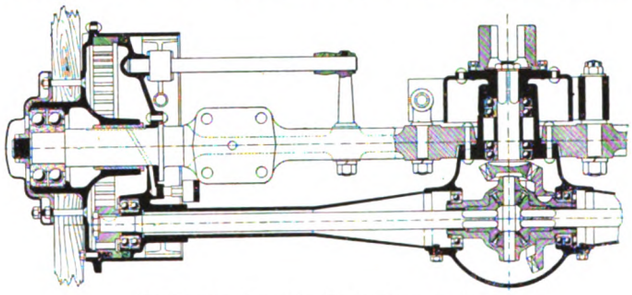
The simplest of all was that in which both torque and thrust were taken by the springs, and for a vehicle primarily intended for use on roads with good surface, and for moderate load variations over the back axle, as on a London omnibus, it might be recommended on the score of cheapness and light weight. It was, however, not very suitable for rough roads and big load variations, as on a goods lorry.

Brakes.—Axle Lubrication.—Alluding to brakes, the author said the practice of fitting both sets on the back axle, acting directly within drums fitted to the road wheels, had found many advocates since this arrangement was adopted for London motor omnibus service. There appeared to be no objection to the system provided the general design of the complete vehicle would permit of the extra width which the two brakes should occupy when arranged side by side. The brake-cam spindle should always be well supported, and in this respect the Straker arrangement of twin brakes showed that the matter had received careful attention.

" The axle," said the author, " is one of the parts which never receives attention in the way of lubrication at the hands of some drivers, to which may be added the springs. Men will tinker about for hours with an engine in the endeavour to obtain greater pulling power, whereas the engine most likely is not in the least at fault. Bent axle casings, due to slack tie rods, nearly dry bearings, binding brakes, etc., are frequent causes of the failure of a vehicle to take its full load up a given gradient on the usual gear. The general design of an axle allows of sufficient oil being carried to keep the gears and centre bearings well lubricated for about 1,000 miles of running, but slack joints and badly faced covers may often allow of enough leakage to necessitate more frequent renewals of supply.

" Many makers go to a lot of trouble to prevent the oil passing from the central casing to the wheel bearings, and rely entirely upon grease lubrication for those parts. This may have been a necessary precaution with old forms of axles, but it has been the experience of many makers that better results can be obtained by allowing leakage to occur, provided that steps are taken to catch such leakage and drain it away from the brakes and wheels as shown in the Dennis axle. A little waste oil costs less than a pair of new wheel bushes, not to mention the possible loss of service and inconvenience to the user in the case of a wheel seizure when the vehicle is miles away from home. There appears to be no reason why leaking oil should not be led to other working parts, such as brake cams, etc., and thus dispense with a number of small greasers. An axle is more likely to receive proper attention in the way of lubrication if it gives the driver no more trouble than putting an occasional pint or so of oil into the central casing."

Representative Makers of Axles.—To the author's mind the best of the double-reduction axles he had dealt with was that built by Walker Brothers, of Wigan, and fitted to their Pagefield chassis.



Burford's Double Reduction Axle.

He also referred to the Wrigley subsidy axle, the Wolseley subsidy axle, the Karrier and the Burford. Of the latter he remarked :—"Another axle of unusual design is fitted to the Burford 2-ton chassis. In this axle the load carrier is a solid forging having a comparatively small circular enlargement in the centre, through which the bevel pinion housing of the driving gear case protrudes forward. The driving gear case is thus relieved of all load-bearing stresses, excepting those due to the drive. Spur pinions on the outer ends of the differential shafts transmit the final drive to internally-toothed racks on the road wheels. These spur gears, together with the wheel brake mechanism, are completely enclosed. The footbrake drum is mounted at the forward end of the bevel pinion shaft, the cast shoes being anchored to members projecting from the axle forging."

In opening the discussion, Colonel R. E. Crompton, C.B., said the main objection to a live axle was the question of unsprung load. He did not agree with the author in saying that little was known about the damaging effect of unsprung weight. The question of damage done to roads, resulting from a combination of unsprung weight, was now being considered by the Departmental Committee of the Local Government Board. The leakage of oil was a serious matter for the tires of other vehicles. The London General Omnibus Company had got over this difficulty by the use of oil trays.

Mr. W. D. Williamson said he had been unable to get definite information as to the wearing properties of tires on chain-driven and live axle vehicles respectively. Therefore unsprung weight could not be so important as Colonel Crompton would have them believe.

Mr. O. D. North asked if it would not be possible to forge the under pan solid with the axle. The springs were capable of taking

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the driving thrust and the torque. Springs should be long, and the point of attachment as low as possible. He had found the Dennis brake car was superior to all others. There was no better brake drum than the Straker.

Mr. G. F. Woollard advised that in the matter of ball bearings the makers' lists should be adhered to if no trouble was desired. If a differential brake was used it should be put in the position shown on the Burford axle.

Mr. H. G. Burford endorsed Colonel Crompton's views on unsprung weight, and said it had been for that reason he favoured the form of transmission employed on the Burford car, whose axle was one-third the weight of any ordinary axle. He believed that he was the first to introduce into this country a 5-ton vehicle with ball bearings.

Major Shilson submitted for inspection drawings of the Jeffrey quad axle. In this truck the back axle was also the steering axle, the differential having a spiral gear.

In replying, Mr. Watson urged that while unsprung weight should be limited as much as possible, it should not be allowed to govern design He believed that in the new regulations the Local Government Board would allow greater weight for back axles.

MOTOR COMPANIES' DIVIDENDS.

Halley's Motor Company.—An interim dividend of 5 per cent., free of tax, has been declared.

Arrol-Johnston, Limited.—A final dividend of 10 per cent. for the past year, free of tax, is recommended, carrying forward £20,485.

Austin Motor Company.—The net profits for the year were £64,322, including £413 brought forward. A dividend of 6 per cent. is proposed, writing £12,626 off preliminary expenses, placing £4,750 to reserve, and carrying forward £5,446.

Albion Motor Company.—The net profits for the past year amounted to £61,722. After transferring £14,000 to the reserve, the directors recommend a final dividend on ordinary shares of 10 per cent. and a bonus of 2s. per share, making 25 per cent. for the 12 months, subject to income tax, and carrying forward £19,445.

Vauxhall Motors Company.—The net profits for 1915 were £50,263, and £5,765 was brought forward. It is recommended writing off the balance of preliminary expenses £4,761, paying a dividend of 10 per cent., transferring to ordinary reserve to meet, among other purposes, any excess profits taxation, £25,000, and carrying forward £8,920.

Clayton and Shuttleworth, Limited.—Mr. A. Shuttleworth presided at the annual meeting of shareholders at Lincoln, on April 20. The net profits for the year, including £15,832 brought forward, totalled £88,619, out of which £25,750 has been transferred to the reserve fund. A dividend of 7½ per cent. was sanctioned on the ordinary shares, carrying forward £22,370.

Wolseley Motors, Limited.—After providing for all expenses, contingencies and depreciation of buildings, etc., and after charging repairs and maintenance to revenue, the trading for the year has resulted in a net profit of £172,893. The directors recommend a dividend of 7 per cent. on preference shares and a dividend of 20 per cent. on 300,000 ordinary shares (tax free), placing £30,000 to reserve, and carrying forward £6,513.

Association of British Motor and Aircraft Manufacturers, Limited.—This association has been registered, the signatories being: E. Manville; F. R. Simms; F. W. Shorland; J. M. Young (Thornycroft's); R. Dennis; H. T. Vane; A. Spurrier; H. Johnson; S. Straker; H. C. B. Underdown; G. M. Young (Albion); F. Bolye Monkman. The secretary is Mr. Horace Wyatt, and the registered offices are at 173, Fleet Street, E.C. The registration necessitates the voluntary liquidation of the Associated British Motor Manufacturers, Limited, of which Mr. Wyatt will act as liquidator.

Repairing of London County Council Road Motors.—After consultations with the chief officers, London County Council Tramways and the fire brigade, the special committee of the London County Council on war estimates have come to the conclusion that it is not possible at present to make any alteration in the system of repairing and maintaining the motor vehicles of the two departments. Mr. A. C. L. Fell reported that the motor lorries and motor cars of the tramways department are repaired at the Belvedere Road garage, the staff consisting of seven men. As regards a suggestion that the tramways department should repair the fire brigade vehicles, he reported that the plant and shops at the Charlton depot were overcrowded with the work of the tramways.

COMMER CHARS-A-BANCS IN CANADA.

For industrial purposes the Commer chassis has long occupied a leading position in Canada and the United States, despite the competition of American machines.

A Route Traversed by Commer Chars-a-Bancs.

The favour extended to the Commer vehicle is the result of the excellent records which it is able to show in many countries besides the United Kingdom, combined with competent representation on the selling side.

Of late years the company have developed the use of their chassis in Canada for chars-a-bancs traffic, for which there is great scope. The extensive use of the Commer car for this purpose in Ottawa

Commer Chars-a-Bancs in Ottawa.

alone is shown by the view on this page of the vehicles drawn up in the neighbourhood of the Parliament buildings.

Another illustration gives an indication of the hilly routes that Commer chars-a-bancs traverse.

City of London Coroner and Accident Prevention.—In his annual report for 1915, Dr. Waldo, the Coroner for the City of London and Southwark, states that he held inquests on 63 traffic fatalities, the highest number since the introduction of motors. The increase synchronises with the darkening of the streets dating from October, 1914, and he advises the adoption of the following preventative measures:—(1) More street refuges—including such in broad streets along which tramcars run. (2) More police, stationed especially at traffic crossing points. (3) More lifeguards or fenders—at least in the shape of sideguards for hind wheels—for all heavy motors.

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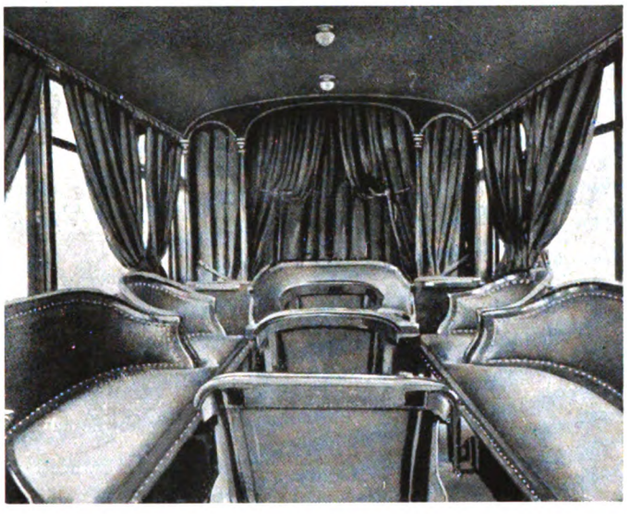
MOTOR TRAFFIC.

FUNERAL OMNIBUSES.

Motor hearses and motor cars, the latter accommodating two or four persons besides the casket, are not unknown in this country. Perhaps the first example of this form of service was given by the Bristol Tramways and Carriage Company, which has long possessed an admirable motor department. There is scope for an enlargement upon their efforts by the numerous motor transport companies in other parts of the country.

In carrying out this work, there is hope that the companies will not only benefit their proprietors, but will be giving the most powerful impetus possible to the movement for funeral reform. This cause is bound to make but slow progress all the while the lumbering horse hearses and carriages continue to be used. There is no need for the traction company to enter into rivalry with the funeral furnishing firms. The place of the companies would be to supply the vehicles, which would be hired by the funeral directors.

At present, funeral vehicles, both motor and horse, are perhaps



Interior of a Brill Funeral Omnibus.

Exterior of a Brill Funeral Omnibus.

the most unremunerative carriages in existence, for except when journeying to and from the cemetery they are useless. No doubt it would be possible to reverse this unsatisfactory state of affairs by providing a funeral omnibus, which would be capable of conveying the whole party of mourners as well as the departed person. Besides having the advantage that its speed would enable it to do duty at more than one interment in a day, the vehicle could be so planned and furnished as to enable it to be used for other engagements in the evening.

Such is the intention of the J. G. Brill Company, of Philadelphia, with the funeral omnibuses that they have constructed. In the first place the exterior is not embellished with the black-blue hue that prevails in this country as one of the "trappings of woe." The exterior of the omnibus illustrated on this page is finished in dark green, while the black silk curtains are removable. In their description of the vehicle the Philadelphia manufacturers of tramcars and omnibuses state that "its arrangements and fittings are such that it can be utilised with equal facility for more joyous occasions."

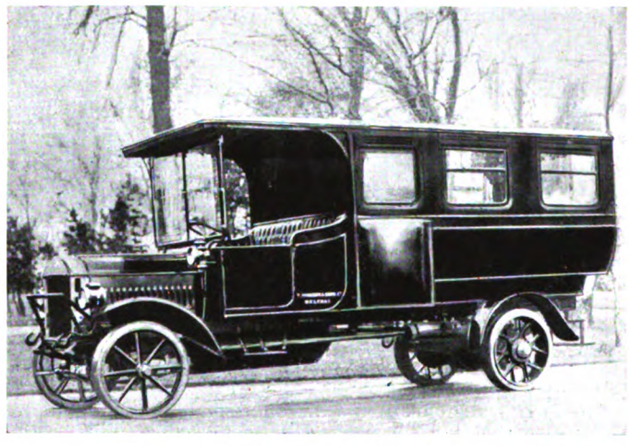
There are three compartments—the front one for the driver, the centre one for the casket, and the rear one for the mourners. Access to each of them can be had through doors on either side. The casket chamber is separated from the driver's compartment by a panelled partition of mahogany, and from the passenger part of the car body by a low panelled partition and two turned mahogany columns running to the ceiling. There is also a black silk curtain the full width of the interior between the casket and passenger departments. In each of the upper rear corners is an electric fan; the battery for driving the fans and supplying light to the five ceiling domes being carried under the left-hand portion of the driver's seat. Under the seat also is the petrol tank. In the left-hand rear corner of the passenger's compartment is a water cooler, while a mirror is panelled into the opposite corner.

Special attention has been devoted to the design of the seating accommodation for the mourners. There are three settees and five arm chairs, all of mahogany and upholstered in real leather. A transverse seat, also upholstered in leather, runs across the rear of the car. All interior woodwork of the three compartments, including panelling, mouldings, and ceiling, is of mahogany, and all hardware and metal fittings are silver-plated.

DENNIS COMBINATION HEARSE.

When its merits become known there should be a considerable demand for the combination motor hearse introduced by Dennis Brothers (1913), Limited, of Guildford, an illustration of which is given below.

This double-purpose vehicle has been supplied to a Belfast firm.



Dennis Hearse and Omnibus.

The body is removable, and a plain lorry body can be substituted when required. For this operation lifting hooks are fitted. The compartment for carrying the coffin is situated behind the driver's seat, and there is accommodation for two coffins. The bulk of the body space remains available for use as an omnibus or for carrying mourners.

ARROL-JOHNSTON EMPLOYEES' WAR FUND.—Last year the employees of the Arrol-Johnston motor factory at Dumfries raised £833 among themselves, and at the instance of Mr. T. C. Pullinger, the managing director, the company supplemented that sum by a donation equal to 30 per cent. of the total. The fund has given assistance to thirteen institutions as well as to forty former soldier employees of the firm and their dependents. The company, who employ 600 men, are engaged on Government orders.

COTTON INDUSTRY MOTOR TRANSPORT COMPANY, LIMITED.—The registered particulars of this company, which has been formed owing to the difficulties experienced in railway transport between Liverpool, Manchester, etc., are as follows:—Registered office, 4, Norfolk Street, Manchester. Private company, with a capital of £41,000 in 40,000 ordinary shares of £1 each, and 20,000 deferred shares of 1s. each. To carry on the business of running motor-driven vehicles, etc. Directors:—W. H. Midwood, H. L. Roxburgh, T. W. Cooke, B. S. Stott, J. Hoyle, A. L. Ormrod, H. E. Holmes, and J. R. Dixon.

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MOTOR TRAFFIC.

MOTOR VEHICLES FOR MUNICIPALITIES.

LEEDS GAS COMMITTEE have resolved to purchase two motor wagons.

CALCUTTA COUNCIL have purchased a car for the use of the accounts department.

ECCLES COUNCIL have invited tenders for the supply of a motor ambulance and a motor disinfecting van.

HARROGATE COUNCIL have purchased a 40-H.P. Daimler lorry, at £892, for the use of the highways department.

BIRKENHEAD SANITARY COMMITTEE are sending a deputation to various towns in order to investigate the various methods of motor haulage.

BIRMINGHAM COUNCIL have agreed to the Baths Committee's recommendation for the purchase of a motor car for the use of the baths superintendent at £180.

LAMBETH COUNCIL have received a report stating that the use of two motor-driven street sweeping machines has displaced 30 horse-drawn sweepers, and effected a saving of £827 in six months.

BRADFORD CLEANSING COMMITTEE have sanctioned the purchase of 25 handcarts for the use of street sweepers and two motor tractors, at a cost of £550, for the conveyance of loaded cart bodies to tips.

DERBYSHIRE COUNTY COUNCIL are purchasing two motor wagons, at £1,470, owing to the scarcity of team labour for road maintenance. The Road Board are advancing the money on loan, free of interest.

HOLBORN COUNCIL have accepted an offer of Hill's Patent Motor Vacuum Road Cleanser, Limited, to hire one of their road sweepers to the Council for the sum of £20 a week for three months, inclusive of attendance and all running charges.

HULL TRAMWAYS COMMITTEE have directed the electrical engineer to obtain prices for the supply of two motor tower wagons. Mr. J. Wilkinson, the electrical engineer, expressed the opinion that battery vehicles would be both efficient and economical.

BRIGHTON GUARDIANS have received the sanction of the Local Government Board to the purchase of three Ford motor vans, at £487. At present the authority hire motor vans, and it is estimated that the saving anticipated from the new scheme will in one year equal the cost of the vehicles.

ILFORD COUNCIL have received a report from their electrical engineer to the effect that the average cost per ton of coal delivered by the Edison battery wagon is about 9d. per ton, inclusive of wages, energy, maintenance, capital charges, insurance, etc. The cost for horse cartage was 11d. and 1s. per ton.

SOUTHEND TRAMWAYS COMMITTEE have received an offer from Edison Accumulators, Limited, offering to supply additional omnibus chassis at £890 each, and to replace existing chassis with their new model, less an agreed sum in respect of depreciation. The committee have deferred consideration of the offer until after the war.

PLYMOUTH CORPORATION GAS COMMITTEE have agreed to purchase an eighth Mann steam wagon. The Works Committee have instructed the borough engineer to present a report on the use of mechanical and horse traction for refuse collection, general cartage, watering, and cleansing. Two Mann wagons are at present in use.

GREAT YARMOUTH COUNCIL have had a report presented by Mr. J. W. Cockrill, the borough surveyor, stating that during the year ended March 31 last the steam wagons had worked on 714 days at a cost of £463, including wages, repairs, water, oil, and fuel. That was equal to 13s. a day worked. Adding 5s. a day, which would be sufficient to purchase a new steam wagon in eight years, the total cost would be 18s. per day each. For the year ended March 31, 1915, the expenditure on horse hire and contract was £3,153, but in the year just ended it was only £618.

INSTITUTION OF AUTOMOBILE ENGINEERS.—On April 12, at the Surveyors' Institution, 12, Great George Street, S.W., Major B. W. Shilson read a paper entitled "From Engine to Axle." This paper was intended as a connecting link between the papers recently read by Messrs. G. W. Watson and W. D. Williamson, and the three papers together cover the whole field of the engine and transmission of the petrol-driven heavy motor vehicle.

PETROL CONTROL COMMITTEE.—The President of the Board of Trade has appointed Mr. Oliver Bury (chairman), Mr. A. E. Bowen, Sir John Hewett, and Mr. P. G. L. Webb to be a committee to control the supply and distribution of petrol and to consider what measures are necessary in the national interest. Mr. H. W. Cole, of the Board of Trade, will act as secretary to the Committee, whose offices will be at 29, Abingdon Street, Westminster, S.W. The committee are not prepared to consider individual applications for supplies of petrol.

MOTOR TRAFFIC NOTES.

BRADFORD MUNICIPAL GARAGE.—A committee of Bradford Corporation have recommended that a garage and petrol store be erected at Dumb Mill, at an estimated cost of £1,268.

BIRMINGHAM AND MIDLAND OMNIBUS COMPANY.—A license for one year has been granted to this company by Malvern Urban Council to run a service in their district, with extensions to Worcester, Droitwich, and Birmingham.

AMBULANCE WITH HEATING APPARATUS.—The first ambulance car in England to be fitted with heating apparatus was presented to the Mayor of Wandsworth on April 8 by the school children of Wandsworth for the use of the locally raised battalion.

SCARCITY OF INDUSTRIAL VEHICLES.—In their half-yearly report the directors of the South Suburban Gas Company state that the delivery of coke to consumers in London has been seriously interfered with by the scarcity of conveyances for road transport. The company make considerable use of motor vehicles.

OMNIBUS SERVICES IN NOTTINGHAMSHIRE.—Some time ago a company inaugurated a motor omnibus service from Nottingham to Ilkeston. Plans have been prepared for additional services from the city to several county centres, such as Derby and Mansfield. The services will also serve mining districts. As deliveries of the vehicles are received, licenses will be applied for.

COMBINED LORRY AND CHARS-A-BANC.—During the Easter holidays a motor lorry, convertible into a chars-a-banc, was run between Baildon Bridge terminus of Bradford tramways and the moor that has been acquired by the Corporation at Baildon. Success seems to have attended the enterprise, the fare for the uphill journey being 4d. and a penny less the other way. The extension of the tramways has been deferred owing to the war.

AN IMPROVED SOLID TIRE.—The Goodrich Company, who a short time ago brought out their "P.B." (protected base) band tires in inch sizes, have just put upon the market tires in millimetre sizes. The makers consider that the advantages to be obtained from the new type are so important that they will have a marked effect upon the future type of all band tires. Some of the characteristics of the new type are easy application, greater strength, better union between rubber and steel, and better protection to the hard rubber base.

HOURS OF WOMEN OMNIBUS CONDUCTORS.—Mr. Cathcart Wason asked the Home Secretary in the House of Commons how many hours a day girls and young men were employed as conductors on London motor omnibuses. Mr. H. Samuel replied:—I am informed that the hours for women and men are practically identical, and vary from nine to twelve hours. The earliest shifts begin at 6 a.m. and the latest finish at midnight. The times off daily vary from about forty minutes to four hours. I understand that the majority of the women do not work more than four or five days a week.

IMPORTANCE OF ROAD MOTORS TO BATH TRAMWAYS COMPANY.—Sir J. Sievwright, who presided at the annual meeting of the company on April 27, said the decrease of £5,558 in the receipts was largely attributable to the reduction of the company's motors when, in the latter part of 1914, a large number of them were transferred to the Government for military service for which the company, had been paid. Economies in operation and the expenses of the company more than met the diminution in receipts, and owing to the reduction in this direction the actual revenue for 1915 was greater than in the previous year. Operating as they had been without the greater part of their torpedo car fleet, they had been successful and compared favourably with the previous corresponding period. There was a promising future before the company, and if they pursued their present policy they would have an improved fleet, and the foundry, which was taken over two years ago, would be extended.

OXFORD OMNIBUS EMPLOYEES AND MILITARY EXEMPTION.—Application was made to the Oxford Military Tribunal by the local Electric Tramways Company, who operate motor omnibuses only, for the absolute exemption of their chief engineer, electrician, fitter's mate, unit adjuster, and thirteen motor drivers. Mr. A. A. Tyler, the manager, stated that the company were under a statutory obligation to run omnibus services, and it was necessary to retain all drivers now left. The company had 92 men and 36 girls. Of the 113 men employed at the outbreak of war and those employed since, 119 had gone into the army. In reply to the military representative, Mr. Tyler said there were 38 drivers. They worked three men to each two onmibuses. There were about thirty omnibuses, but they could not all be utilised owing to the shortage of drivers. Conditional exemption as being in a certified occupation was granted in respect of the chief engineer, the electrician, the fitter's mate, and the unit adjuster. The other thirteen cases were adjourned for two months.

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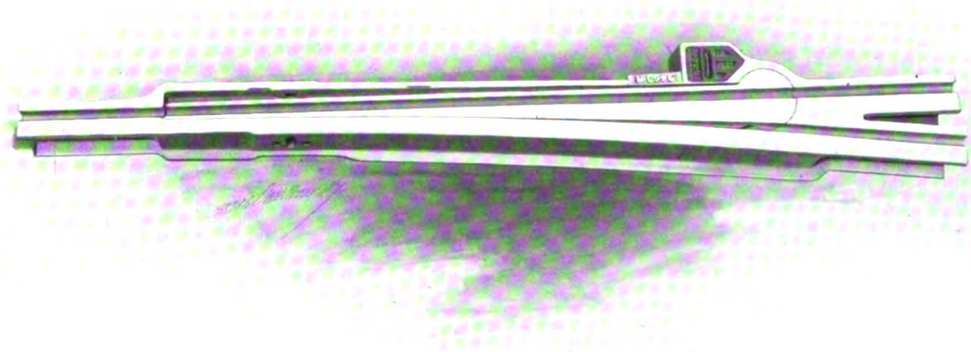

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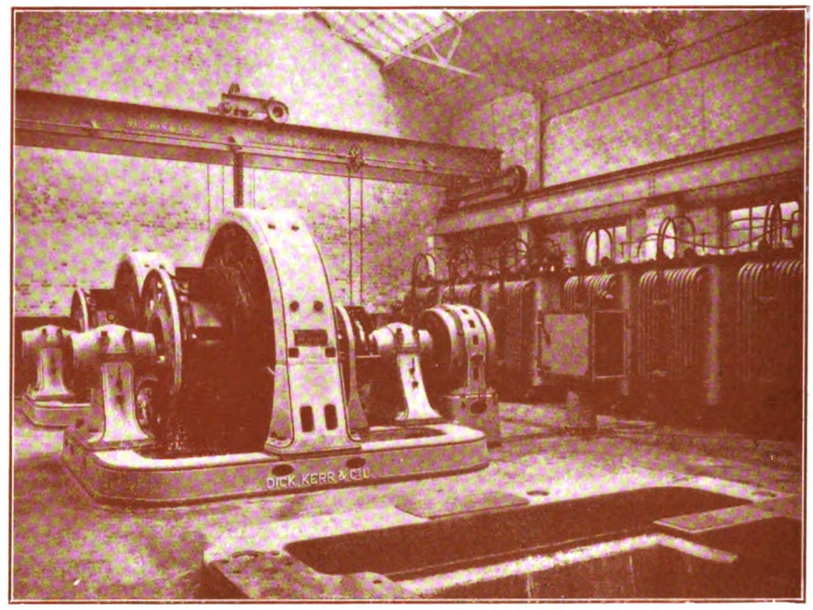
in Sub-station of Lancashire & Yorkshire Railway



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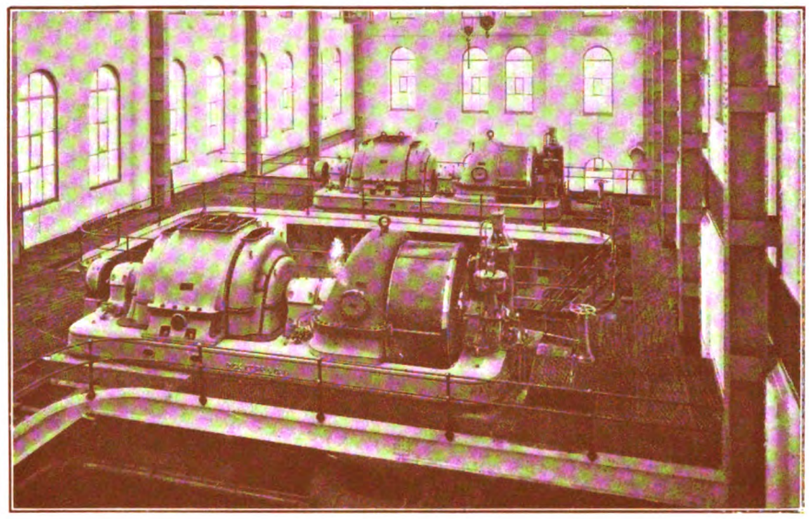
in Power Station of Lancashire & Yorkshire Railway



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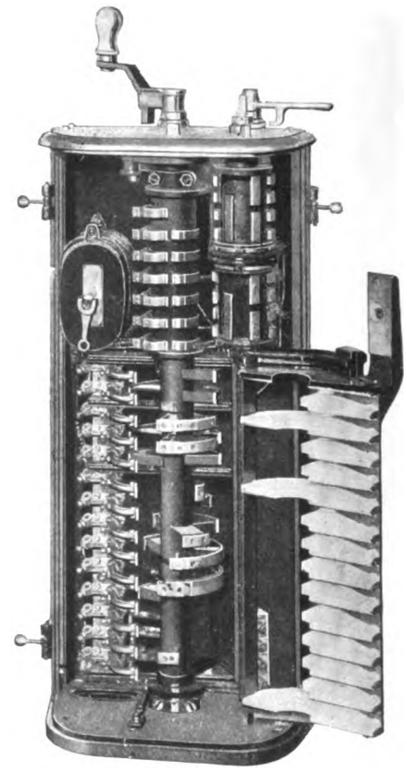

Interior view of B49 Controller

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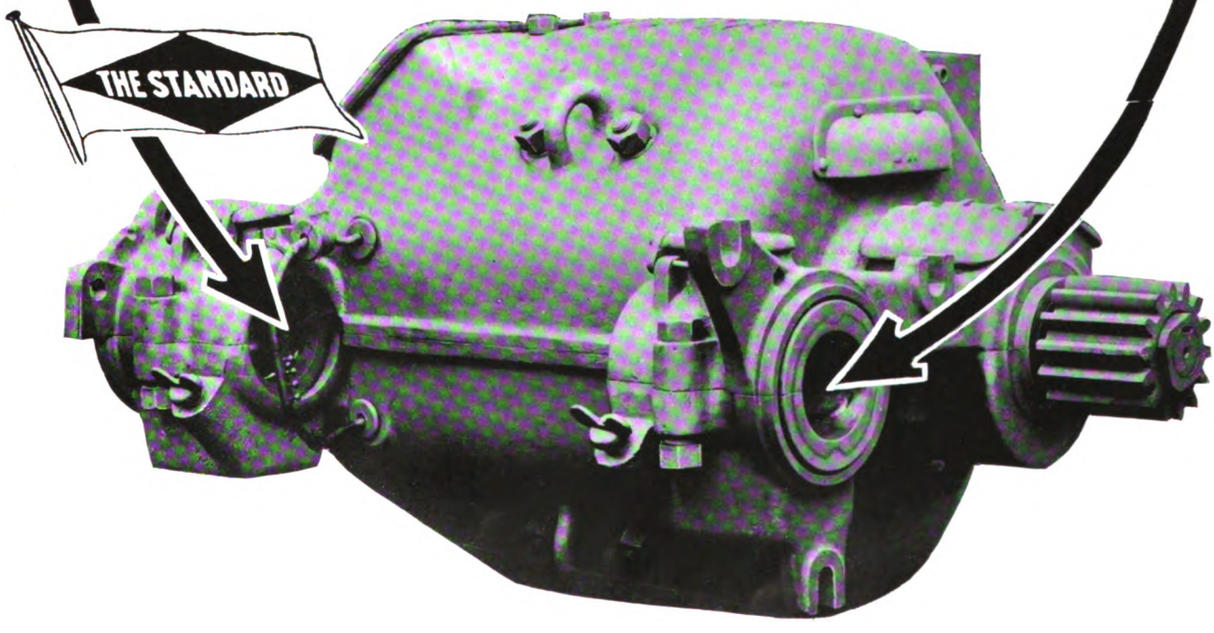

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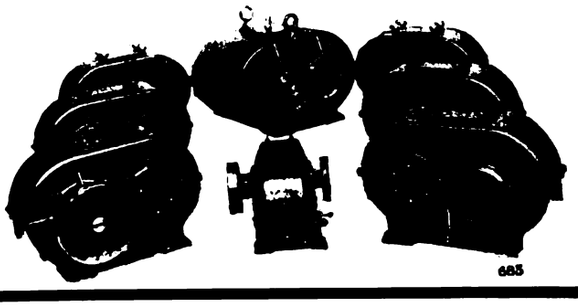

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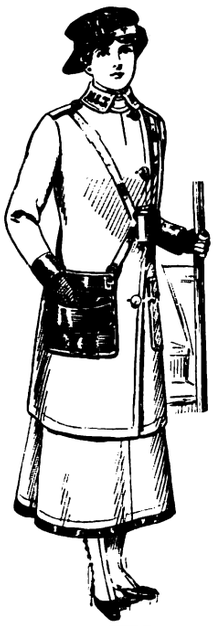

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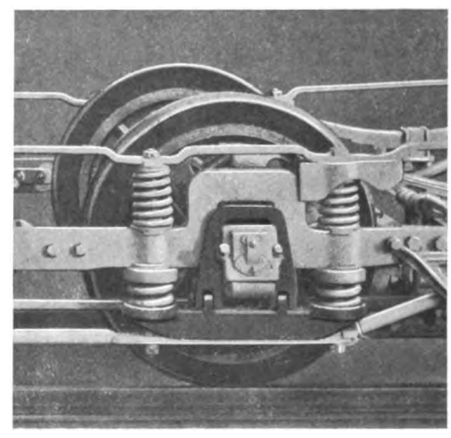

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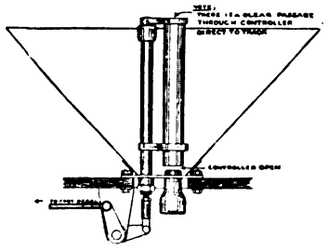

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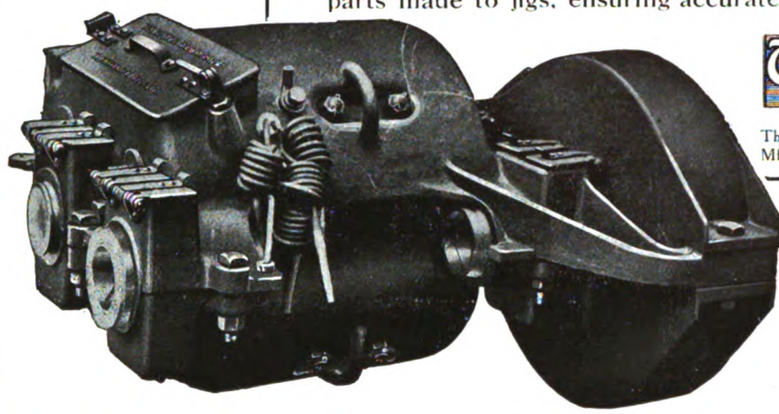

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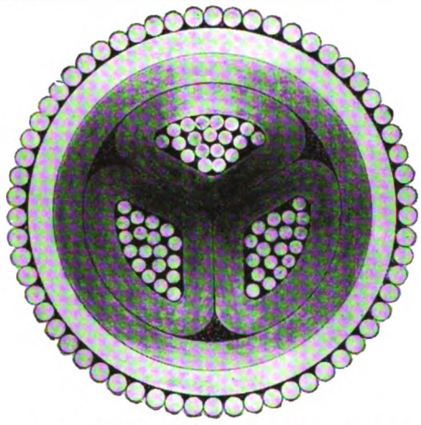

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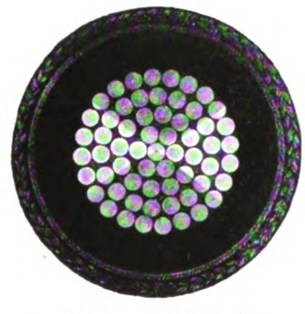

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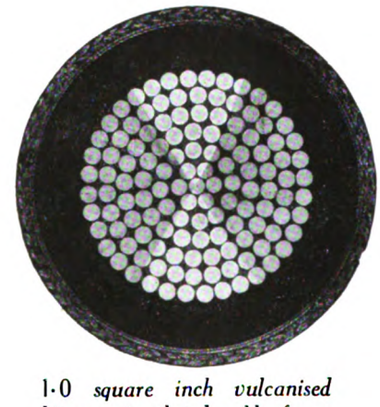

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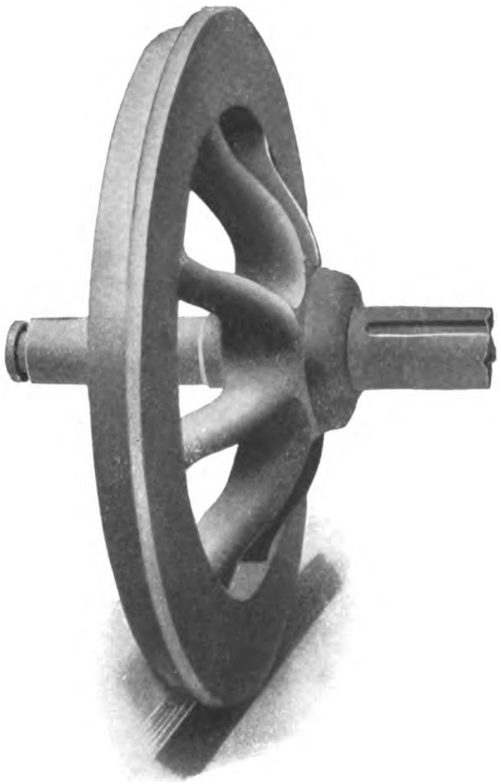

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Aberdare Urban District Tramways, Gadlys Estate, Aberdare. [T.A., Tramways, Aberdare: T.N., 17.] *Gen. Manager and Elec. Engineer*, A. J. Abraham; *Traffic Supt.*, H. King; *Chairman Try. Com.*, Coun. E. Stonelake.

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[Lines leased to and worked by the Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Belfast City Tramways, Tramways Office, Sandy Row, Belfast. [T.A., Nance, Tramway, Belfast; T.N., 2444.] *Gen. Manager*, Andrew Nance; *Traffic Manager*, R. McMaster; *City Elec. Eng.*, T. W. Bloxam; *Per. Way Eng.*, E. S. Pinkerton; *Chief Eng.*, A. A. Blackburn; *Chairman Try. Com.*, Coun. J. McCaughey; *Vice-Chairman*, Coun. J. Warwick.

Bexley Urban District Council Tramways, Car Sheds, Bexleyheath, Kent. [T.A., Stokes, Tramways, Bexleyheath; T.N., 79.] *Gen. Manager and Elec. Eng.*, H. P. Stokes; *Rolling Stock Supt.*, A. Williams; *Chairman Try. Com.*, Coun. E. T. Coote; *Vice-Chairman*, Coun. E. F. Reid.

Birkenhead Corporation Tramways, Laird Street, Birkenhead. [T.A., Tramways Manager, Birkenhead; T.N., 1110.] *Gen. Manager*, C. Clarke; *Borough Sur. and Eng.*, C. Brownridge; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Coun. H. Halsall; *Vice-Chairman*, Coun. R. Frame.

Birmingham Corporation Tramways, The Council House, Congreve Street, Birmingham. [T.A., Trams, Birmingham; T.N., Central 7,000.] *Gen. Manager*, A. Baker; *City Elec. Eng.*, R. A. Chattock; *Traffic Supt.*, J. McDonnell; *Per. Way Eng.*, C. E. S. Bill; *Rolling Stock Supt.*, R. H. Dickinson; *Chairman Try. Com.*, Coun. H. Barrow, J.P.; *Vice-Chairman*, Coun. A. G. Ellaway.

Blackburn Corporation Tramways, Tramways Office, Blackburn. [T.A., Tramways, Blackburn; T.N., 547.] *General Manager*, J. H. Cowell; *Elec. Eng.*, P. P. Wheelwright; *Traffic Manager*, E. Greek; *Car Shed Supt.*, H. W. Seymour; *Chairman Try. Com.*, Ald. W. Thompson; *Vice-Chairman*, Coun. C. Higham.

Blackpool Corporation Tramways, West Caroline Street, Blackpool. [T.N., 67.] *Gen. Manager*, C. Furness; *Traffic Supt.*, C. J. Baker; *Resident Eng.*, F. Field; *Chairman Try. Com.*, Ald. J. Brodie, J.P.; *Vice-Chairman*, Ald. R. Holt (Mayor).

Bolton Corporation Tramways, Bradshawgate, Bolton. [T.A., Manager, Tramways, Bolton; T.N., 490.] *General Manager*, J. Barnard; *Elec. Eng.*, W. J. H. Wood; *Per. Way Eng.*, E. Ll. Morgan; *Rolling Stock Supt.*, C. Beech; *Chairman Try. Com.*, Ald. J. Miles; *Vice-Chairman*, Coun. P. Higson.

Bootle Corporation Tramways, Electricity Works, Pine Grove, Bootle. [T.N., 424.] *Elec. Eng.*, T. D. Clothier; *Chairman Try. Com.*, Ald. Booth; *Vice-Chairman*, Coun. Pennington.

[Lines worked by Liverpool Corporation Tramways.]

Bournemouth Corporation Tramways, Tramways Offices, Lansdowne Crescent, Bournemouth [T.A., Tramways, Bournemouth; T.N., 1701.] *General Manager*, I. Bulfin; *Chief Assistant & Elec. Eng.*, H. Vickers; *Traffic Supt.*, R. O. Baldwin; *Chairman Try. Com.*, Coun. Bell; *Vice-Chairman*, Coun. McCabe.

Bradford Corporation Tramways, Central Office, 7, Hall Ings, Bradford. [T.A., Tramways, Bradford; T.N., 2381 and 2382.] *Gen. Manager*, C. J. Spencer; *Asst. Elec. Eng.*, J. W. Dawson; *Traffic Supt.*, T. Stirk; *City Elec. Eng.*, T. Roles; *Chairman Try. Com.*, Coun. Enoch Priestley; *Vice-Chairman*, Coun. J. Lund.

Brighton Corporation Tramways, Lewes Road, Brighton. [T.A., Tramways, Brighton; T.N., 353 P.O.] *Eng. & Manager*, William Marsh; *Traffic Supt.*, W. N. Brooks; *Rolling Stock Supt.*, W. Orchard; *Per. Way Eng.*, F. N. Hudson; *Chairman Try. Com.*, Coun. Martin.

Burnley Corporation Tramways, Queen's Gate, Burnley. [T.N., 46.] *Gen. Manager*, Henry Mozley; *Boro. Elec. Eng.*, J. E. Starkie; *Boro. Surveyor*, G. H. Pickles; *Chairman Try. Com.*, Coun. E. Heap; *Vice-Chairman*, Coun. Irving.

Burton-on-Trent Corporation Tramways, Guild Street, Burton-on-Trent. [T.N., 202.] *Manager*, A. B. Slater; *Engineer*, T. Hall; *Chairman Try. Com.*, Ald. J. S. Rowland (Mayor); *Vice-Chairman*, Ald. T. E. Lowe.

Bury Corporation Tramways, Market Place, Bury. [T.N., 26.] *Gen. Manager*, William Clough; *Boro. Elec. Eng.*, S. J. Watson; *Chairman Try. Com.*, Ald. T. S. Collinge; *Vice-Chairman*, Coun. Hargreaves.

Cardiff Corporation Tramways, Central Offices, The Hayes, Cardiff. [T.A., Tramways, Cardiff; T.N., 1211, 1240, 1350, and 377.] *Gen. Manager and Elec. Eng.*, A. Ellis; *Deputy Manager*, C. G. M. New; *Traffic Manager*, H. David; *Per. Way Eng.*, W. Harpur; *Rolling Stock Supt.*, Jas. Preston; *Chairman Try. Com.*, Ald. Sir J. W. Courtis, J.P.; *Vice-Chairman*, Coun. A. J. A. Stone.

Chester Corporation Tramways, Station Road, Chester. [T.N., 166.] *Traffic Supt.*, W. H. Ellis; *Elec. Eng.*, S. E. Britton; *Per. Way Eng.*, W. M. Jones; *Chairman Try. Com.*, Ald. J. Jones; *Vice-Chairman*, Coun. A. S. Dutton.

Chesterfield Corporation Tramways, Chatsworth Road, Chesterfield. [T.A., Tramways, Chesterfield; T.N., 78.] *Gen. Manager and Elec. Eng.*, R. L. Acland; *Traffic Manager*, F. Root; *Per. Way Eng.*, C. E. Crossley; *Chairman Try. Com.*, Ald. E. Shentall (Mayor); *Vice-Chairman*, Coun. Woodhead.

Colchester Corporation Tramways, Magdalen Street, Colchester. [T.A., Tramways, Colchester; T.N., 92.] *Gen. Manager and Engineer*, R. C. Bullough; *Chairman Try. Com.*, Coun. A. M. Jarmin; *Vice-Chairman*, Coun. J. T. Bailey.

Colne Corporation Tramways, Colne, Lancashire. *General Manager and Engineer*, T. G. Richardson; *Chairman Try. Com.*, Coun. R. Knight (Mayor).

Coventry Corporation Tramways, Priestley's Bridge, Coventry. [T.A., Tramways, Coventry; T.N., 1014.] *Engineer and General Manager*, T. R. Whitehead; *Assistant Engineer*, W. M. Milnes; *Chairman*, Coun. C. V. Pugh; *Vice-Chairman*, Coun. H. W. Wale.

Croydon Corporation Tramways, Tramways Office, Thornton Heath, Surrey. [T.A., Tramways, Croydon; T.N., 406, Croydon.] *Tramways Manager*, T. B. Goodyer; *Chairman Try. Com.*, Ald. G. J. Allen; *Vice-Chairman*, Coun. A. A. Thomson.

Darlington Corporation Tramways, Haughton Road, Darlington. [T.A., Tramways, Darlington; T.N., 2435.] *General Manager and Elec. Eng.*, J. R. P. Lunn; *Traffic Supt.*, J. Fraser; *Chairman Try. Com.*, Ald. C. W. Starmer.

Dartford Urban District Council Tramways, Dartford. *Chairman Try. Com.*, Coun. R. Bennett; *Vice-Chairman*, Coun. J. B. Walton.

[Leased. See Dartford Tramways in list of Tramway Companies.]

Darwen Corporation Tramways, Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, F. J. S. Hosken; *Boro. Elec. Eng.*, C. H. Garnett; *Chairman Try. Com.*, Ald. Jas. Tomlinson.

Derby Corporation Tramways, 4, Victoria Street, Derby. [T.N., 410.] *Gen. Manager*, F. Harding; *Elec. Eng.*, T. P. Wilmshurst; *Per. Way Eng.*, J. Ward; *Chairman Try. Com.*, Coun. J. Dean.

Doncaster Corporation Tramways, Grey Friar's Road, Doncaster. [T.A., Rayner, Doncaster, T.N., 43.] *Manager & Elec. Eng.*, E. S. Rayner; *Chairman Try. Com.*, Coun. P. Stirling (Mayor); *Vice-Chairman*, Coun. Balmforth.

Dover Corporation Tramways, Town Hall, Dover. [T.A., Trams, Dover; T.N., 294.] *Gen. Manager*, E. Carden; *Per. Way Eng.*, W. C. Hawke (Boro. Surveyor); *Chairman Try. Com.*, Coun. Barwick; *Vice-Chairman*, Coun. Norman.

Dundee Corporation Tramways, Town House Buildings, Dundee. [T.N., 1340]; *Gen. Manager and Eng.*, Peter Fisher; *Elec. Eng.*, H. Richardson; *City Eng.*, J. Thomson; *Chairman Try. Com.*, Coun. G. A. Johnston.

East Ham (County Borough of) Corporation Tramways, Nelson Street, East Ham. [T.N., 611 and 100, East Ham.] *Gen. Manager and Elec. Eng.*, W. C. Ullmann; *Chairman Try. Com.*, Ald. M. Oakes.

Eccles Corporation Tramways, Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Ald. W. J. Nuttall, J.P.; *Vice-Chairman*, Coun. Alexander.

[Lines worked by Salford Corporation.]

Erith Urban District Council Tramways, Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, J. C. Williams; *Chairman Try. Com.*, Coun. G. C. Humphreys.

Exeter Corporation Tramways, Paris Street, Exeter. *Manager*, H. C. Bartlett; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, Ald. H. B. Varwell; *Vice-Chairman*, Coun. F. G. Towill.

Farnworth Urban District Council Tramways, Albert Road, Farnworth. *Chairman Try. Com.*, Coun. S. C. Steele; *Vice-Chairman*, Coun. Stanley.

[Lines leased to the South Lancashire Tramways Co.]

Glasgow Corporation Tramways, 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., 1040, Douglas.] *Gen. Manager*, J. Dalrymple; *Traffic Supt.*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Elec. Eng.*, E. T. Goslin; *Sec.*, J. N. Wilson; *Chairman Try. Com.*, Coun. Montgomery; *Vice-Chairman*, Bailie Kelly.

Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts; *Vice-Chairman*, Coun. C. J. Ramstedt.

Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant *Per. Way Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Coun. J. T. C. Salmon.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 36 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A. Fawcett.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager and Elec. Eng.*, Barnes Kay; *Per. Way Eng.*, J. S. Green (Borough Surveyor); *Chairman Try. Com.*, Coun. Waddington; *Vice-Chairman*, Coun. Haworth.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Eng. and Manager*, H. C. Dufton.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 47.] *Gen. Manager*, R. B. Leach; *Per. Wa Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Coun. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

Huddersfield Corporation Tramways, Northumberland Street, Huddersfield. [T.N., 698 and 398.] *Gen. Manager & Elec. Eng.*, R. H. Wilkinson; *Assist. Engineer*, A. P. Quilliam; *Traffic Supt.*, T. Hartley; *Borough Eng.*, K. F. Campbell; *Chairman Try. Com.*, Coun. E. H. Sellers; *Vice-Chairman*, Coun. T. Canby.

Hull Corporation Tramways, Alfred Gelder Street, Hull. [T.N., 444, Corporation.] *Manager*, Wm. J. McCombe; *Elec. Eng.*, J. Wilkinson; *Per. Way Eng.*, F. W. Bricknell (*City Engineer*); *Chairman Try. Com.*, Ald. J. H. Hargreaves (Lord Mayor); *Vice-Chairman*, Coun. W. Wheatley.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager and Engineer*, L. E. Harvey; *Chairman Try. Com.*, Coun. W. J. T. Cullis; *Vice-Chairman*, Coun. Owen Waters.

Ilkeston Corporation Tramways, Park Road Ilkeston. [T.A., Bellamy Ilkeston; T.N., 26.] *Manager and Elec. Eng.*, L. C. F. Bellamy; *Chairman Try. Com.*, Coun. J. E. Bestwick; *Vice-Chairman*, Coun. Kane.

Ipswich Corporation Tramways, Constantine Road, Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome; *Vice-Chairman*, W. P. Burton.

Kearsley Urban District Council Tramways, Council Office, Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.

[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, South Street, Keighley. [T.A., Tramways, Keighley; T.N., 17.] *Gen. Manager and Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. A. Smith.

Kilmarnock Corporation Tramways Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, W. C. Bexon; *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com.*, Bailie Jones.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Kirkcaldy Corporation Tramways, Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson.

Leeds City Tramways, Swinegate, Leeds. [T.A., Tramways, Leeds; T.N., 44 and 169; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Per. Way Eng.*, R. B. Holt; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Boro. Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Judge Hall.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. J. A. Hennah.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Stanley Clegg, Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White; *Vice-Chairman*, Coun. M. A. Ashley.

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, C. W. Mallins; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *City Electrical Engineer*, Harold Dickinson; *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Coun. E. Russell Taylor; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 62, Finsbury Pavement, London, E.C. [T.A., Lotram Ave., London; T.N., 3321, 3322, and 3323 London Wall.] *Chief Officer*, A. L. C. Fell; *Deputy Chief Officer*, J. K. Bruce; *Traffic Assist.*, L. Slattery; *Rolling Stock Supt.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, G. H. Hume; *Vice-Chairman*, T. Prestige.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett.

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Coun. D. T. J. Lyle; *Vice-Chairman*, Coun. Green.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Coun. F. Goodyear.

Middleton Corporation Tramways. *Consulting Engs.*, Lacey, Sillar, and Leigh; *Chairman Try. Com.*, Ald. W. Wood, J.P. (Mayor); *Vice-Chairman*, Ald. Bentley, J.P.
[Worked by Manchester Corporation Tramways.]

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. R. Mayne; *Vice-Chairman*, Coun. A. M. Sutherland.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 990 L., Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Per. Way Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways. St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis; *Vice-Chairman*, Coun. W. Beale.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain, J.P.; *Vice-Chairman*, Ald. F. R. Radford, J.P.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, P. Priestley; *Traffic Supt.*, J. Brierley; *Chairman Try. Com.*, Ald. F. G. Isherwood; *Vice-Chairman*, Coun. F. Elliot.

Perth Corporation Tramways, 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Calderwood.

Plymouth Corporation Tramways, 15, Ebrington Street, Plymouth. [T.N. 518, Plymouth.] *General Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.* Ald. S. H. Phillips, J.P.; *Vice-Chairman*, Coun. J. Moon.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Inspector*, W. May; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 110 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson; *Vice-Chairman*, Ald. R. Payne.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Traffic Supt.*, C. H. Manning; *Chairman, Try. Com.*, Ald. J. Ormrod; *Vice-Chairman*, Coun. T. Parkinson.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Walker Allen, J.P.
[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81 and 85.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. J. W. Stansfield.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P. (Deputy Mayor).

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, S. S. Platt; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. Taylor.

Rotherham Corporation Tramways, Rawmarsh Road, Rotherham. [T.A., Cross, Rotherham; T.N., 138, 152, and 241.] *General Manager & Elec. Eng.*, E. Cross; *Deputy Elec. Eng.*, J. R. Lilleker; *Traffic Superintendent*, H. Jagger; *Per. Way Eng.*, T. P. Collinge; *Rolling Stock Supt.*, C. A. Walker; *Chairman Try. Com.*, Ald. D. L. Winter; *Vice-Chairman*, Coun. T. Reeves.

St. Helens Corporation Tramways, Town Hall, St. Helens, Lancs. *Chairman Try. Com.*, Ald. Sir J. Beecham; *Vice-Chairman*, Coun. W. N. Pilkington.
[Lines worked by the New St. Helens and District Tramways Co.]

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, J. A. Robertson; *Traffic Supt.*, J. W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. W. H. Barrett.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Traffic Supt.*, A. Handford; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. Com.*, Ald. Sir W. Clegg, J.P.; *Vice-Chairman*, Coun. A. T. Bescoby, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, Wm Redman; *Chairman Try. Com.*, H. Pitts.
[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, W. T. Robson; *Boro. Elec. Engineer*, H. F. Street; *Traffic Manager*, C. G. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. Daniells; *Per. Way Eng.*, E. J. Elford (*Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Ald. A. Martin.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Piermaster*, Capt. N. E. Hucker; *Chairman*, Coun. H. Dowsett.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Ald. Griffiths, J.P.; *Vice-Chairman*, Coun. Clayton.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, H. S. Ellis; *Chairman Try. Com.*, Ald. W. G. Wylie; *Vice-Chairman*, Ald. J. W. Henderson.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Coun. S. C. Homer.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Ald. Chas. Sharples; *Vice-Chairman*, Ald. W. E. Hamnett.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Chairman Try. Com.*, Coun. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker, J.P.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *Manager*, T. Medcalf; *Elec. Eng.*, A. Dimmack; *Consulting Engs.*, Lacey, Sillar, & Leigh; *Chairman Try. Com.*, Coun. A. D. Richards; *Vice-Chairman*, Coun. A. Bull.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1431, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H. Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

Walsall Corporation Tramway, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. Clarke; *Vice-Chairman*, Coun. R. J. Bishop.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Coun. Dr. G. W. Joseph; *Vice-Chairman*, Coun. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Try. Com.*, Ald. A. G. Turley, J.P. (Mayor); *Vice-Chairman*, Coun. G. Garratt.
[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 868 East.] *General Manager*, J. S. D. Moffet; *Boro' Elec. Eng.*, J. W. Beauchamp; *Chairman Try. Com.*, ————.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Charlton.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *Gen. Manager*, F. Buckley; *Per. Way Eng.*, A. T. Gooseman; *Chairman Try. Com.*, Ald. R. T. Fletcher; *Vice-Chairman*, Coun. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. W. H. Sessions.

COMPANY TRAMWAYS.

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, W. Jackson, Dr. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles, G. J. Somerville.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *Acting Manager*, W. E. Nicoll; *Acting Sec.*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Barrow; T.N., 125.] *Manager*, W. F. Bladon; *Sec.*, F. J. Cursons; *Acting Sec.*, J. S. Bowker; *Chairman*, H. S. Day; *Directors*, J. V. Kitchener, E. R. Soames.

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, Hon. Sir J. Sivewright, K.C.M.G.; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton, E. Callaird.

Bessbrook and Newry Tramway Company, Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, Robert Caven; *Elec. Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, T. McGreggor Greer.

Birmingham District Power and Traction Company, Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone, R. J. Howley.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Blackpool and Fleetwood Tramroad Company, Ltd., Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 121.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, John Greenwood; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington, G. Richardson, G. Readman.

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Blackpool, St. Anne's, and Lytham Tramways Company, Ltd., Squires Gate, and 80, Birley Street, Blackpool. [T.N., 327 and 22]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, G. Nicholson; *Directors*, T. M. Smith, T. Preston.

Bray and Enniskerry Railway Company, 52, Westland Row, Dublin. *Sec.*, M. F. Keogh; *Chairman*, A. Killingley; *Director*, F. M'Crea.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, Magnus Volk; *Traffic Superintendent*, H. Sheppard; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Chas. Challenger; *Assist. Manager*, S. E. Smith; *Electrical Engineer*, W. H. Munton; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, Sir G. White, Bart.; *Directors*, W. G. Verdon Smith (*Managing*), S. White, J.P., J. H. Howell, J.P., G. Stanley White.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. E. Garcke (*chairman*); *Directors*, C. Shirreff B. Hilton, W. L. Madgen, A. Shepherd, G. T. Symons, C. G. Tegetmeier. P. D. Tuckett; *Joint Managers*, C. H. Dade and R. J. Howley; *Acting Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.
Barnsley & District.
Barrow-in-Furness.
Birmingham & District Power & Traction Co.:
Birmingham & Midland
Dudley, Stourbridge, & District.
South Staffordshire.
Wolverhampton Dist.
Devonport & District.
Gateshead & District.
General Elec. Tramways.
Gravesend & Northfleet.
Greenock & Port Glasgow.
Jarrow & District.
Kidderminster & District.
Merthyr.
Middleton.
Oldham, Ashton, & Hyde.
Peterborough.
Potteries.
Rothesay.
Sheerness & District.
South Metropolitan.
Southport.
Swansea.
Taunton.
Tynemouth & District.
Weston-super-Mare & District.
Worcester.
Wrexham & District.
Yorkshire (Woollen Dist.)

Burton and Ashby Light Railways, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, A. L. Charles; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Douglas Owen.

Carlisle Tramways Company, Ltd., City of, Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, R. L. McCulloch.

Chatham and District Light Railways Company, Luton Road, Chatham, and 83, Cannon Street London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Traffic Manager*, W. G. Davies; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Directors*, A. H. Beatty (*Chairman*), W. Shearer, H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C. A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, St. George's Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, Capt. W. Martindale, H. C. Levis.

Dartford Urban District Council Light Railways. Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Balfour, Beatty, & Co., Ltd., 66, Queen Street, London, E.C.) *Acting Manager*, F. A. Kincaid Fergusson.

Devonport and District Tramways Company, Electrical Federation Offices, London, W.C. [T.A., Head Office, Devonport c/o Tramway, London; T.N., Head Office, Holborn 2686. *Manager and Eng.*, George Cardwell; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier, R. J. Sutcliffe.

[The Company's undertaking has been sold to Plymouth Corporation.]

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways, (Lessees: The National Elec. Construction Co., Ltd., 3, Laurence Pountney Hill, London, E.C.) [T.A., Overhauled, London; T.N., 5329 and 5330 Bank.] *Manager*, W. MacGibbon.

Douglas—Ramsey. (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282 and 4006 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, A. B. Coyle, J.P., G. N. Murphy.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. Marshall Harriss; *Elec. Eng.*, R. Tanham; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, W. M. Murphy, J.P.; *Directors*, W. F. Cotton, J.P., J. Mooney, Rt. Hon. L. A. Waldron, P.C.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley.

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 23, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, J. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager & Engineer*, Daniel Fisher; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A. Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Secretary*, H. W. Davis; *Chairman*, H. S. Day; *Directors*, H. A. Stagg, C. R. Greene, Judge L. A. Atherley-Jones, K.C.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, F. J. S. Moore; *Directors*, C. M'D. Stuart, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 84, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, A. W. Bullough; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C [T.N., 958, Gravesend.] *Manager*, J. R. Groves; *Sec.*, H. C. Walter; *Chairman*, W. L. Madgen; *Directors*, P. N. Gray, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A. Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, E. Valied, J. B. Collings, Q. Le Pelley.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. Vincent Edwards; *Secretary*, W. R. Elston; *Cons. Engs.*, Kincaid, Waller, Manville, and Dawson; *Chairman*, G. Kitchen; *Directors*, E. C. Morgan, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, W. G. Verdon Smith; *Manager*, F. Freshwater; *Chairman*, Sir George White, Bart.; *Directors*, H. C. Godfray, J. H. Howell, S. White.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, ——————; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, W. M. Murphy, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *General Manager*, W. G. Bond, *Secretary*, B. Kingsford; *Chairman*, E. Garcke; *Directors*, J. A. Lycett, H. S. Day, W. L. Madgen.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager and Engineer*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. A. Stanley M.P.; *Directors*, J. M. Henderson, M.P., Sir J. Beecham, J.P., R. Watson, J.P., A. Adam, J. S. Austen.

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, W. H. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey J. U. Hodgson, M. H. Maxwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

Llanelly and District Electric Lighting and Traction Company, Ltd., Llanelly, and 66, Queen Street, London, E.C. *Engineer and Manager*, J. E. Stewart; *Secretary*, G. D. Prince; *Chairman*, A. R. Holland; *Directors*, A. V. Anderson, M. A. Edwards, A. H. Beatty.

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *Gen. Manager and Eng.*, A. H. Pott; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, Sir A. H. Stanley, F. V. Schuster.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, A. E. Wray.

Mansfield & District Light Railway Co., Sutton Road, Mansfield. [T.A., Cars, Mansfield, T.N., 107.] *Gen. Manager and Sec.*, Stanley Dudman, *Chairman*, A. R. Holland; *Directors*, W. J. Chadburn, A. H. Beatty, G. Balfour.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, C. A. Huni; *Chairman*, Col. Sir A. Griffith Boscawen; *Directors*, Sir W. H. Vaudrey, B. E. Greenwell, E. Remnant.

Merthyr Electric Traction and Lighting Company, Ltd., 58, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London. W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Secretary*, S. J. Clements; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

Metropolitan Electric Tramways, Limited, Electric Railway House, Broadway, Westminster, London, S.W. [T.A., Metrolito, London; T.N., 6800, Victoria.] Manor House Offices, Seven Sisters Road, N. [T.A., Lentiscus, London; T.N., 77 Tottenham.] *Gen. Manager and Eng.*, A. H. Pott; *Traffic Manager*, W. E. Hammond; *Secretary*, A. L. Barber; *Chairman*, E. Garcke; *Directors*, Sir E. Spencer, W. L. Madgen, C. G. Tegetmeier, J. Devonshire (*Managing Director*).

Mexborough and Swinton Tramways Company, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 3, Laurence Pountney Hill, Cannon Street, London, E.C. *Manager and Eng.*, G. H. Browne; *Cons. Elec. Eng.*, F. E. Stanley; *Commercial Manager*, Wm. T. Mitchell; *Traffic Supt.*, M. McLeod; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Director* (*Managing*), W. B. Cownie, C.A.

Middlesbro, Stockton, and Thornaby Electric Tramway, Bridge Road, Stockton-on-Tees, and Clare Street House, Bristol. [T.A., Tramways, Stockton; T.N., 129.] *Manager*, F. Freshwater; *Secretary*, W. G. Verdon Smith; *Chairman*, Sir Geo. White, Bart.; *Directors*, H. C. Godfray, S. White, H. C. Doggett.

Middleton Electric Traction Company, Ltd., Hiltonfold Lane, Middleton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depot, Middleton; T.N., 37 Middleton.] *Gen. Manager*, W. F. Endean; *Secretary*, G. R. Oliphant; *Acting Secretary*, J. S. Bowker; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreathall.

Morecambe Tramways Company, Heysham Road, Morecambe, and 62, Market Street, Lancaster. [T.N. 1, Morecambe, and 71, Lancaster.] *Secretary and Manager*, G. H. Petty; *Chairman*, W. H. Pickles; *Directors*, J. Stott, S. Wright, O. Carr.

Musselburgh and District Electric Light and Traction Co., Ltd., High St., Musselburgh, N.B. [T.A., Tramways, Musselburgh; T.N., 115.] (Registered Office, 3, Laurence Pountney Hill, London, E.C. [T.N., 5329 and 5330, Bank.]) *Manager*, R. Watson; *Resident Engineer*, E. J. Walsh; *Traffic Inspector*, W. Mittell; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, B. Burnham, J. Anderson, W. B. Cownie, R. Watson.

New General Traction Company, Ltd., 8, Crosby Square, London, E.C. *Managing Director*, E. A. Hopkins; *Secretary*, J. G. Mills; *Chief Engineer*, I. E. Winslow; *Chairman*, Baron E. B. d'Erlanger. [This company controls the Norwich and the Douglas Southern Electric Tramways Companies.]

New St. Helens and District Tramways Company, Ltd., Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36 Atherton.] *Engineer and Manager*, C. D. Stanley; *Secretary*, H. P. Conibear; *Chairman*, Hon. Arthur Stanley, M.P.; *Directors*, J. Hunter, J.P., H. Martin, J.P., J. M. Henderson, M.P., J. S. Austen, and E. H. Edwardes (*Managing*).

North Shields Tramway Company owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

Norwich Electric Tramway Company, 5, Orford Hill, Norwich, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, F. W. Ketley; *Consulting Eng.*, I. E. Winslow; *Sec.*, J. G. Mills; *Directors*, E. A. Hopkins, Hon. A. G. Brand, F. FitzGerald, G. M. Chamberlin, and C. Pakeman.

Nottinghamshire and Derbyshire Tramways Company, Tramway Depot, Langley Mill, Derbyshire, and 66, Queen Street, London, E.C. [T.A., Tramways, Langley Mill; T.N., 53, Langley Mill.] *Manager*, C. R. Walker; *Secretary*, Wm. C. Bryden; *Directors*, A. R. Holland, A. H. Beatty, A. V. Anderson, and M. A. Edwards.

Oldham, Ashton and Hyde Electric Tramway, Ltd., Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Denton; T.N., 265 Ashton.] *Supt.*, A. Anderson; *Secretary*, F. J. Cursons; *Acting Secretary*, J. S. Bowker; *Chairman*, E. Garcke; *Directors*, Judge L. A. Atherley Jones, K.C., W. S. Wreathall, J. V. Kitchener (*Managing Director.*)

Paisley District Tramways Company, Tramway Depôt, Paisley, and 83, Cannon Street, London, E.C. [T.N., 218 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Lord Arthur Butler, D. Johnston Smith, John Young.

Peterborough Electric Traction Company, Ltd., Lincoln Road, Peterborough, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Peterborough; T.N., 224.] *Gen. Manager*, T. G. Clabburn; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, Lord Vaux of Harrowden; *Directors*, E. A. Paris, R. J. Howley.

Plymouth, Stonehouse and Devonport Tramways Co., 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. [T.N. 53.] *Manager*, G. H. Moreton; *Elec. Eng.*, J. Graham Pearce; *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*).

Portsdown and Horndean Light Railway, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Engineer and Manager*, J. Fereday Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern.

Potteries Electric Traction Company, Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Stoke-on-Trent; T.N., 141.] *Gen. Manager and Eng.*, W. Thom; *Power and Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, B. Kingsford; *Chairman*, R. J. Howley; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

Rhondda Tramways Company, Ltd., Tramway Depot, Porth, Rhondda, and Laurence Pountney Hill, Cannon Street, London, E.C. [T.A., Tramways, Porth; T.N., 118.] *Manager and Engineer*, H. Holliday; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, H. T. Barnett.

Rothesay Tramways Company, Ltd., Point House, Rothesay, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, A. C. Miles; *Directors*, W. L. Madgen, H. S. Day.

Ryde Pier Company, Ryde, Isle of Wight. *Manager*, W. D. Stanney; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

Scarborough Tramways Company, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, J. V. Moinet; *Chairman*, F. E. Gripper; *Directors*, V. Fowler, M. T. Whittaker, J. C. Wigham.

Sheerness and District Electric Power and Traction Company, Ltd., Electricity Works, Sheerness East, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Sheerness; T.N.,45.] *Manager & Eng.*, A. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, R. J. Howley, E. R. Soames.

Snaefell Mountain Railway (See Manx Electric Railway Company).

South Metropolitan Electric Tramways and Lighting Company, Ltd., 114, Church Street, Croydon, 30, High Street, Sutton, and Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 304 Croydon, 14 Sutton and 6800, Victoria.] *Gen. Manager and Engineer*, A. V. Mason; *Secretary*, W. M. Wright; *Chairman*, C. G. Tegetmeier; *Directors*, J. Devonshire (*managing*), E. Garcke, A. L. Barber.

Southport Pier Co., Ltd., Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, A. T. Faiers; *Chairman*, A. Skinner; *Directors*, J. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

Southport Tramways Company, Ltd., The Depôt, Churchtown, Southport, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, J. Lloyd; *Secretary*, H. A. Stagg; *Chairman*, C. S. Hilton; *Directors*, J. S. Raworth, Lord Vaux of Harrowden, J. V. Kitchener, G. R. Hulme.

South Staffordshire Tramways (Lessee) Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, W. S. Schuster; *Directors*, J. A. Lycett, S. R. Blundstone, R. J. Howley, B. Kingsford.

Sunderland District Electric Tramways. Ltd., Fence Houses, co. Durham. [T.A., Trams, Philadelphia, Shiney Row; T.N., 21, Houghton-le-Spring.] *Resident Manager and Engineer*, G. Stratton; *Traffic Manager*, E. A. Pearman; *Secretary*, H. J. Almond; *Directors*, H. R. Hogg, Hon. R. Parker, R. Tayler, A. Counter, C. Eves.

Sutton and Howth Electric Tramway Company (owned by the Great Northern Railway, Ireland), Sutton, county Dublin, and Amiens Street Station, Dublin. [T.A., Railroad, Dublin; T.N., 171, Dublin, and 16 Sutton.] *Gen. Manager*, John Bagwell; *Elec. Eng.*, A. W. Whieldon; *Chief Eng.* F. A. Campion; *Locomotive Eng.*, G. T. Glover; *Sec.*, T. Morrison; *Chairman*, F. Vernon; *Directors*, W. P. Cairnes (*Deputy Chairman*), W. B. Carson, H. S. Guinness, J. T. Reade, Capt. W. L. A. Goulding, Lt.-Col. J. C. W. Madden, R. A. Gradwell, J. Milne Barbour, T. F. Cooke, W. H. B. Moorhead, Lt.-Col. H. Plews, G. S. Clark.

Swansea Improvements and Tramways Company, 2, Rutland St., Swansea, and Electrical Federation Offices. Kingsway, London, W.C. [T.A., Tramway, Swansea; T.N., 268 Swansea.] *Gen. Manager*, D. James; *Elec. Eng.*, A. Johnston; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, G. J. Somerville, S. E. Garcke, E. R. Soames.

Taunton Electric Traction Company, Ltd., East Reach, Taunton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Taunton, c/o "Tramways," London.] *Manager*, B. H. Griffith; *Acting Manager*, L. Marshall; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, G. J. Somerville; *Directors*, E. Garcke.

Torquay Tramways Co., Ltd., St. Marychurch Road, Torquay. [T.A., Carsheds, Torquay; T.N., 167 Torquay.] *Registered Office*, 3, Laurence Pountney Hill, Cannon Street, E.C. *Manager and Eng.*, H. J. Nisbett; *Secretary*, L. D. H. Jacobs; *Managing Director*, W. B. Cownie.

Trafford Park Company (Tramways), Trafford Park, Manchester. [T.A., Developing, Manchester; T.N., 61, Trafford Park.] *Secretary*, C. A. Grundy; *Chairman*, Marshall Stevens; *Directors*, Sir J. Lyons, H. McNiel.

[Lines worked by the Manchester and Salford Corporations.]

Tynemouth and District Electric Traction Company, Limited, John Street, Cullercoats, Northumberland, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tram Co., Cullercoats; T.N., 17 Whitley.] *Gen. Manager*, H. J. Smith; *Sec.*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. H. Robinson, J. B. Williamson, R. J. Howley, Geo. J. Somerville.

Tyneside Tramways and Tramroad Company, Ltd., Neptune Bank, Wallsend. [T.A., Tramways, Wallsend; T.N., 84.] *Secretary & Res. Manager*, J. C. Little; *Elec. Eng.*, F. H. Briggs; *Cons. Eng.*, W. McLellan; *Chairman*, J. T. Merz; *Directors*, Lord Armstrong, J. H. Armstrong, G. E. Henderson, S. Hunter.

Wakefield and District Light Railway Company, Belle Isle, Wakefield.

[This company has been amalgamated with the Yorkshire (West Riding) Electric Tramways Co., Ltd.]

Walton-on-the-Naze Pier Tramway (Coast Development Corporation, Ltd.), The Pier, Walton-on-the-Naze. [T.A., Electricity Works, Walton-on-Naze.] *Eng.*, E. A. Lambert, A.M.I.E.E.

Wemyss and District Tramways Company, Ltd., Car Depot, Aberhill, Methill, N.B. [T.A., Tramways, Methill; T.N., 38 Leven.] *Gen. Manager*, W. T. Dawson; *Sec.*, J. O. Shepherd; *Chairman*, G. Balfour; *Directors*, W. Shepherd, G. Balfour, J. H. Guild.

Weston-super-Mare and District Electric Supply Co., Ltd., Locking Road, Weston-super-Mare, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Weston-s.-Mare; T.N., 79 & 181.] *Manager and Elec. Eng.*, G. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, E. R. Soames.

Wolverhampton District Electric Tramways, Limited, Tramway Depot, Bilston, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Bilston; T.N., 56, Bilston.] *General Manager*, W. G. Bond; *Sec.*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley, B. Kingsford.

Worcester Electric Traction Company, Ltd., St. John's, Worcester, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Worcester; T.N., 81.] *Engineering Manager*, R. Simpson; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. A. Lycett, B. Kingsford, W. S. Wreathall.

Wrexham and District Transport Co., Ltd., 6, Lord Street, Wrexham, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Wrexham; T.N., 182, Wrexham.] *Manager*, A. A. Hawkins; *Sec.*, J. R. Oliphant; *Acting Sec.*, J. S. Bowker; *Chairman*, J. V. Kitchener; *Directors*, G. J Somerville, W. S. Wreathall.

Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. [T.A., England, Belle Isle, Wakefield; T.N., 213.] *Gen. Manager and Sec.*, H. England: *Elec. Engs.*, C. J. Jewell and E. A. Wood; *Traffic Supt.*, W. J. McDonald; *Chairman*, Sir Herbert S. Leon, Bart.; *Directors*, B. Newgass, G. E. Leon, E. Remnant, W. Murray.

Yorkshire (Woollen District) Electric Tramways, Limited, Frost Hill, Liversedge, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Heckmondwike; T.N., 8 Heckmondwike.] *Secretary*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Sir Thos. Pilkington, E. A. Paris (*managing*).

TRAMWAY ASSOCIATIONS.

MUNICIPAL TRAMWAYS ASSOCIATION.

President:
PETER FISHER
(General Manager, Dundee Corporation Tramways).

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(General Manager, Bradford Corporation Tramways), 7, Hall Ings, Bradford.

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LIST OF ELECTRIC TRAMWAYS & RAILWAYS.

PARTICULARS OF TRACK AND EQUIPMENT.

TRAMWAYS, pp. xxvii-xxx. RAILWAYS, p. xxx.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No of Motor Cars.	No of Dynamos	No. of Engines	Type of Engines	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS.				ft. in.	lbs.	1 in	ft. rad.						
Aberdare Urban District Trys. ..	Oct., 1913	2·9	3·3	3 6	96 G	13	45	14	2	2	V. Cp. C.	400	Lanc. Dynamo Co.
Aberdeen Corporation	Dec., 1899	14·4	27·75	4 8½	96 G	13	42·5	83	*14	14	V. Cp. C.	4,610	British T-H. Macartney & Co.
Aberdeen Suburban Trys. Co. ..	June, 1905	5	5	4 8½	95 G	28	90	9	..	..	..	..	J. G. White & Co. Brush Co.
Accrington Corporation	Aug., 1907	7·53	10·53	4 0	95 G	14	..	32	*8	8	..	1,888	Brush Co.
Airdrie & Coatbridge Tramway Co.	Feb., 1904	3·63	4·94	4 8½	94 G	14	210	15	..	..	..	..	Brush Co.
Ashton-under-Lyne Corporation .	Aug., 1902	7	8·15	4 7¾	96 G	10	40	25	5	5	..	400	Dick, Kerr, & Co. Siemens Bros.
Ayr Corporation	Sept., 1901	6	7·612	4 8½	90 G	21	45	24	*8	8	..	400	British T-H.
Bacup Corporation	1910	1·50	2	4 8½	103 G	9	40	..	..	..	..	..	
Barking Town Urban District ..	Dec., 1903	2·6	3·125	4 8½	100 G	25	44	9	4	3	V. Cp. C.	200	Blackwell & Co.
Barnsley & Dist. Elec. Traction Co.	Nov., 1902	3·06	4·25	4 8½	97 G	10	60	13	*	..	..	..	J. G. White & Co. Brush Co.
Barrow-in-Furness	Feb., 1904	6·9	10·32	4 0	90 G	13	50	24	*8	..	..	..	Brush Co. Dick, Kerr, & Co.
Bath Electric Tramways, Ltd. ..	Jan., 1904	14·7	19·3	4 8½	95 G	10·7	38	40	4	4	H.T. Cp.	675	Westinghouse
Batley Corporation	Aug., 1903	6·536	10·47	4 8½	104 G	9	40	15	6	4	H. Cp.	240	B. I. W. Co. British Elc. Cr. Co
Belfast City	Dec., 1905	49·65	98·54	4 8½	105 G	15	35	291	3	3	Tri. Exp.	3,000	J. G. White & Co. Westinghouse
Bessbrook—Newry (1) .. .. Bessbrook and Newry Try. Co.	Oct., 1885	3	3	3 0	41 V	80	55	2 M 2 T	2	1	Hyd. Turb.	..	Mather & Platt
Bexley Urban District	Oct., 1903	5·25	6·5	4 8½	90 G	14	40	21	3	3	V. Cp.	600	Dick, Kerr, & Co.
Birkenhead Corporation	Feb., 1901	13·8	24·09	4 8½	100 G	13½	40	65	6	6	V. Cp.	..	Blackwell & Co. British T-H.
Birmingham Corporation	Jan., 1904	65·56	114·55	3 6	105 G	13	40	586	..	..	..	1,475	Dick, Kerr, & Co.
Birmingham and Midland Trys. Co.	Nov, 1904	10·32	16·45	3 6	85 & 94 G	15	31	62	6	6	Cp.	..	Brush Co.
Blackburn Corporation	March, 1899	14·67	24·75	4 0	92 G	15	30	61	*4	4	V. Cp. C.	..	British T-H. Blackwell & Co.
Blackpool Corporation	Oct., 1885	14·75	21·38	4 8½	96 G	20	36	84	5	..	Turb.	3,250	Elwell-Parker British T-H.
Blackpool & Fleetwood Tramrd. Co.	July, 1898	7·9	15	4 8½	70 V 98 G	26	80	41	5	5	V. Cp.	600	Mather & Platt D.K.&Co.-B.T-H.
Blackpool and Fylde Light Ry. Co.	Under cons.	14	14·5	4 8½	..	..	..	..	..	..	..	..	
Blackpool—St. Anne's & Lytham ..	May, 1903	7·47	14·03	4 8½	92 G	22	35	40	..	..	..	..	British T-H.
Bolton Corporation	Nov., 1899	26	47·21	4 8½	90 G	14	35	112	*12	12	V. Cp. C.	3,800	Dick, Kerr, & Co. Blackwell & Co.
Bootle Corporation	May, 1900	4·125	7·75	4 8½	95 G	20	40	55	*8	8	..	4,000	Blackwell & Co.
Bournemouth Corporation	July, 1902	21·66	31·75	3 6	100 G 66 slot	10	40	91	5	4	V. Cp.	1,200	J. G. White & Co.
Bradford Corporation	July, 1898	59	108·75	4 0	102 G	9·8	40	‡272	11	11	V. Cp. C.	..	Westinghouse Blackwell & Co.
Bray and Enniskerry Railway Co.	Under cons.	3·25	5	3 6	..	..	..	..	..	..	..	..	Macartney & Co.
Brighton Corporation	Nov., 1901	9·48	17·18	3 6	105 B.S. No. 4	9	40	53	5	5	Turb.	1,000	Westinghouse Blackwell & Co.
Brighton Beach (1)	Aug., 1883	1·75	2	2 8½	35 V	100	80	9	2	..	..	..	Siemens Bros.
Bristol—Bristol Trys. Co.	Oct., 1895	31	57·5	4 8½	92½ G	10	30	232	6	4	V. Cp. C.	..	British T-H. and Blackwell & Co.
Burnley Corporation	Dec., 1901	12·50	22·16	4 0	102 & 107 G	9·8	35	67	*8	6	H. Cp. C.	1,500	British T-H.
Burton and Ashby Light Railway..	July, 1906	10·2	12·3	3 6	90 G	11	51	20	2	2	Diesel	330	Dick, Kerr & Co. Brush Co.
Burton-on-Trent Corporation ..	Aug., 1903	6·67	9·75	3 6	90 & 100 G	11·7	40	20	3	3	V. Cp.	400	Dick, Kerr, & Co. Blackwell & Co.
Bury Corporation	June, 1903	22·5	34·42	4 8½	102¾ G	12	40	54	6	6	..	1,500	Westinghouse
Camborne and Redruth	Nov., 1902	3·75	4	3 6	83 G	15	40	8	7	7	Cp.	1,525	Dick, Kerr, & Co British T-H.
Cardiff Corporation	May, 1902	17·25	31·82	4 8½	100 G	23	35	130	9	9	V. Cp. C. & T	2,200	British T-H. Dick, Kerr, & Co.
Carlisle, City of, Elec. Try. Co. ..	June, 1900	7·25	8·5	3 6	83 G	14	23	12	..	..	..	..	D.K.& Co.-B.T-H.
Cavehill & Whitewell Try. Co...	Feb., 1906	3·29	4·31	4 9	105 G	31	75	10	..	..	..	..	J. G. White & Co.
Chatham & District Light Rly. Co.	June, 1902	14·98	26	3 6	92½ & 105 G	9	35	50	5	4	H. Cp.	675	British T-H. Co. Brush Co.
Cheltenham and District ..	Aug., 1901	10·22	12·25	3 6	80 & 90 G	8·9	37	20	2	2	V. Cp.	..	Westinghouse
Chester Corporation..	April, 1903	3·59	6·4	3 6	94 & 100 G	23	40	18	*7	6 1	V. Cp. C. V. Tri. ExC	240	Blackwell & Co. British T-H.
Chesterfield Corporation	Dec., 1904	3·6	5·1	4 8½	96 & 101 G	20	40	17	4	4	V. Cp. C.	800	Milnes & Co. Westinghouse Brush
Clontarf and Hill of Howth ..	July, 1900	5·5	6·5	5 3	90 & 60 G	13	34	12	..	..	..	..	W.M. Murphy & Co.
Colchester Corporation	July, 1904	6	7·94	3 6	95 G	12	43	18	8	8	V. Cp.	1,140	Dick, Kerr & Co J. G. White & Co.
Colne Corporation Tramways ..	Nov., 1903	5·2	6·7	4 0	102 G	13	60	13	*	..	..	..	Blackwell & B.T-H. Glover & Co.
Cork Elec. Try. & Lighting Co. ..	Dec., 1898	10	15	2 11½	83 G	14	26	35	*9	9	H. Cp. C.	570	British T-H. Blackwell & Co.
Coventry Corporation Tramways..	Dec., 1895	12·88	15·81	3 6	65 G 81 G	16	35	51	5	3	H. & V. Cp.	1,500	Westinghouse Blackwell & Co.
Croydon Corporation	Sept., 1901	11·87	19·12	4 8½	96·5 G	16	40	75	*13	13	..	2,000	British T-H. Co.
Darlington Corporation	June, 1904	4·875	8·88	3 6	90 G	14	52·8	18	1	..	..	250	Westinghouse

* Current from combined lighting and traction station. (1) Third rail system. † Includes 1·25 miles railless trolley line. ‡ Includes 20 railless cars.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars	No. of Dynamos	No. of Engines.	Type of Engines.	Total Capacity Traction, Kw.	Principal Contractors for Electrical Equipment.
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Dartford U. D. C.	Feb., 1906	6·5	8·5	4 8½	100 G	12	35	12	4	..	..	..	British I. W.
Darwen Corporation	Oct., 1900	4·36	7·16	4 0	95 G	9	35	19	*4	4	H. Cp.	..	British T-H.
Derby and Ashbourne	..	..	14·5	..	..	..	..	..	..	..	..	..	J. G. White & Co.
Derby Corporation	July, 1904	13	22·06	4 8½ 4 0	95 G	14	46	50	3	3	Turb.	..	Brush & B.T-H.
Devonport Corporation	June, 1901	..	7	3 6	97 G	10	50	12	..	..	..	..	Blackwell & Co.
Doncaster Corporation	June, 1902	8·25	12·52	4 8½	94 G	16	45	32	8	8	..	1,000	Blackwell & Co.
Dover Corporation	Sept., 1897	4·75	7	3 6	87 & 90 G	10	44	24	*2	2	H.CC.	..	D. K. & B. T-H
Douglas—Port Soderick .. Douglas Southern Elec. Trys. Co.	Aug., 1896	3·25	3·75	4 8½	65 V	12	45	8 M 8 T	2	2	H. Cp.	200	Westinghouse British T-H.
Dublin & Lucan Elec. Railway Co.	March, 1900	6·5	7	3 6	50 V	20	27	9 M 5 T	2	2	H. Cp. C.	240	Dick, Kerr, & Co.
Dublin United Tramways Co.	May, 1896	49·8	95·26	5 3	105 G	12·3	22	365	8	8	Cp & Tur	5,500	Dick, Kerr, & Co. Blackwell & Co. British T-H.
Dudley and Stourbridge Trys. British Electric Traction Co.	July, 1899	22·88	30·97	3 6	90 G	11	50	59	4	4	H. Cp.	..	British T-H. Blackwell & Co.
Dumbarton	Feb., 1907	13	17	4 7¾	90 & 96	14	60	30	3	3	..	..	Dick, Kerr, & Co.
Dundalk	Under cons.	6	6·25	3 6	97 G	10	50	12					White & B.T-H.
Dundee, Broughty Ferry, and District	Dec., 1905	4·125	7·25	4 8½	90 G	16·5	30½	14	3	3	V. Cp. C.	..	J. G. White & Co. British T-H. Co.
Dundee Corporation	July, 1900	16·3	30·25	4 8½	90 & 100 G	10	35	76	5	5	..	..	Blackwell & Co.
Dunfermline (Fife Try. & Power Co.)	Nov., 1909	14·6	17·4	..	90 G	10	25	28	..	..	..	..	British T-H.
East Ham Corporation	June, 1901	7·58	14·20	4 8½	90 & 105 G	25	40	45	*5	5	H. Cp.	750	Dick, Kerr, & Co.
Eccles Corporation	May, 1902	5	7·75	4 8½	100 G	..	..	..	..	..	..	..	
Edinburgh and District	June, 1910	1·25	1·5	4 8½	100 G	21	54	4	..	..	..	..	Dick, Kerr, & Co.
Erith Urban District Council	Aug., 1905	4·7	8·4	4 8½	100 G	17	40	17	3	5	..	..	Brush Co. Westinghouse Co.
Exeter Corporation	April, 1905	4·875	7	3 6	90 G	11·5	35	24	*4	4	H. Cp.	..	Dick, Kerr, & Co.
Falkirk and District	Oct. 1905	7·81	10·5	4 0	90 G.	11·3	48	18	*	..	..	..	Bruce Peebles & Co. British T-H.
Farnworth Urban District	Jan., 1902	4·33	7·16	4 8½	98 G	29	36	..	..	..	..	..	
Felixstowe Pier	Aug., 1905	0·5	0·5	3 6	36	..	..	3	..	..	..	..	
Gateshead and District	May, 1901	12·38	20·02	4 8½	90 G	8	35	55	*	..	..	..	Dick, Kerr, & Co. Blackwell & Co.
Giant's Causeway Elec. Try. Co.	Sept., 1883	8	9	3 0	42 V 75 G	24	30	5 M 21 T	2	2	Hyd. Turb.	..	Siemens Bros. British T-H.
Glasgow Corporation	Oct., 1898	99·26	198·13	4 7¾	110 G	11·93	30¾	857	8	8	V. Cp. & T	21,700	British T-H. Westinghouse
Glossop Urban District	Aug., 1903	4·56	5·6	4 8½	90 G	13	40	8	4	4	V. Cp.	200	British T-H.
Gloucester Corporation Light Rly.	May, 1904	9	15	3 6	90 G	25	40	30	*2	2	Cp.	750	Brush Co. Dick, Kerr, & Co
Gosport & Fareham Trys. Co.	Jan., 1906	7·5	11·5	4 7¾	96 G	16	37½	22	3	3	V. Cp. C.	750	Dick, Kerr, & Co. Brush Co.
Gravesend and Northfleet	Aug., 1902	6·5	9	4 8½	87 G	11	45	18	*				
Great Crosby	June, 1900	2·5	2·5	4 8½	92½ G	..	40	14	*7	7	H. & V. Cp.	160	Dick, Kerr, & Co. Blackwell & Co.
Great Grimsby	Dec., 1901	6	11	4 8½	90 G	15	26	32 M 6 T	3	3	..	400	Dick, Kerr, & Co.
Greenock and Port Glasgow	Oct., 1901	7·425	14·05	4 7¾	90 G	11	60	42	*	..	..	..	
Guernsey Railway Co.	Nov., 1892	3	3	4 8½	74 V 84 G	60	60	9 M 8 T	2	1	H. & V. Cp.	160	Siemens Bros. British T-H.
Halifax Corporation	June, 1898	37·53	55·5	3 6	95½ G	9·5	38·6	101	*7	7	H. & V. Cp. & T.	3,000	Electric Cons. Co. British T-H.
Hampshire Light Railway (Elec.) Co.	March, 1903	6	9	4 8½	..	..	..	10	*	..	..	..	
Haslingden Corporation	July, 1908	3	3	4 0	100 G	10	30	..	..	..	..	45	Dick, Kerr, & Co.
Hastings and District	July, 1905	19·33	34	3 6	90 G	8	30	65	6	6	V. Cp.	2,100	Dick, Kerr, & Co.
Herne Bay Pier (1)	March, 1899	·75	·75	3 0	60	..	..	3	1	1	Gas	50	British T-H.
Heywood Corporation	Dec., 1905	4·25	4·25	4 8½	90 G	17	..	..	1	1	..	300	Blackwell & Co. B.I. & H.C. Co.
Houghton-le-Spring (See Sunderland Dist. Elec. Trys.)													
Huddersfield Corporation	Feb., 1901	34·50	56	4 7¾	98 G	11	35	106	4	4	V. Cp. C.	2,200	British T-H.
Hull Corporation	July, 1899	13·46	30·5	4 8½	94 G	20	30	180	7	7	V. Cp. C.	2,560	British T-H. Westinghouse
Ilford Urban District	Mar., 1903	7·42	12·62	4 8½	95 G	13	33·3	28	*7	7	..	1,600	British T-H.
Ilkeston Corporation	May, 1903	3·8	4·3	3 6	90 G	12	28	13	..	..	..	..	Dick, Kerr, & Co.
Ipswich Corporation	Nov., 1903	10·8	14·87	3 6	90 G	11·5	40	36	*10	10	Enclos'd	1,175	Dick, Kerr, & Co. Westinghouse
Isle of Man— Manx Elc. Rly. Co. Douglas to Ramsey	July, 1893	18	35·75	3 0	62½ V	24	90	34 M 29 T	8	9	H. Cp.	1,300	Mather & Platt
Manx Elc. Rly. Co. Snaefell Mountain	Aug., 1895	4·5	9·5	3 6	56 V	12	90	6	5	4	H. Cp.	390	
Isle of Thanet Trys. & Ltg. Co.	April, 1901	11	20·67	3 6	90 & 100 G	11	38	59	*6	6	3 V. Cp. 3 H. Cp.	800	British T-H. Blackwell & Co.
Jarrow and District	Nov., 1906	2·54	3·42	4 8½	95 G	12·5	50	10	..	..	..	..	Brush Co. B.I. & H.C. Co.
Kearsley Urban District	Jan., 1902	1·75	1·75	4 8½	95 G	20	..	..	..	..	..	..	Westinghouse
Keighley Corporation	Oct., 1904	3·5	6·11	4 0	95 G	25	60	12	*4	4	V.	200	Blackwell & Co. Brush & B.T-H.
Kidderminster—Stourport British Electric Traction Co.	May, 1898	4·6	4·87	3 6	75 G	14	45	13	*5	5	Stm Turb.	..	Brush Elc. Eg. Co
Kilmarnock Corporation	Dec., 1904	4·18	5·5	4 8½	90 G	24	45	14	*3	3	..	250	Blackwell & Co.
King's Norton & Northfield U. D.	May, 1904	5·25	8·25	3 6	105 G	15&21	100&145	..	..	..	..	..	Blackwell & Co.
Kinver	April, 1901	4·25	6	3 6	63 & 90 G	..	..	6					
Kirkcaldy Corporation	Feb., 1903	6·11	8·56	3 6	100 G	11	40	26	*10	6	Cp. H.T.	2,290	British T-H. Co.
Lanarkshire Tramway Co.	July, 1903	28·431	43·120	4 7¾	96 & 101 G	9·4	37	76	4	4	3 H. Cp. 1 V. Cp.	825	British T-H. Co
Lancashire United Tramways Co.	Oct., 1902	39	54	4 8½	90 G	15	50	82	*8	8	V. Cp. C&T	7,000	B. I. W. Co.
Lancaster Corporation	Jan., 1903	4	4·81	4 8½	90 G	8	30	12	4	4	V. Cp.	200	Greenwood & Batley, Ltd.
Leamington & Warwick Elec. T. Co.	July, 1905	3·04	6·1	3 6	65 G	12	47	12	3	3	Cp.	..	Brush Co.
Leeds City	Aug., 1897	69·02	114·62	4 8½	105 & 111 G	8·4	32	345	5 3	5 3	H. Cp C. Stm. Tur	6,150	Elec. Con. Co. Greenwood & Batley, British T-H Blackwell & Co

* Current from combined lighting and traction station. (1) Third Rail system. M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.	Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines.	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.						
Leicester Corporation	May, 1904	20·25	38	4 8½	100 G	16	35	160	7	7	V.Cp.C&T	9,250	Dick, Kerr, & Co. / Blackwell & Co.
Leith Corporation	Aug., 1905	9·08	17·9	4 8½	106·7 G	19	54	37	*11	11	..	1,600	Brush & B.T-H.
Leyton Urban District	Dec., 1906	8·95	17·694	4 8½	105 & 111 G	24	45	60	*4	4	Cp.T.E&T	2,040	..
Lincoln Corporation (1)	Nov., 1905	1·75	2·96	4 8½	100 G	..	36	8	*9	9	..	120	Blackwell & Co. / British T-H.
Liverpool Corporation	Nov., 1898	70	127	4 8½	95, 123 & 134 G	13	30	599	*42	42	Trip.Ex.	44,600	Dick, Kerr, & Co. / Westinghouse
Liverpool Overh'd Ry. (Trol.Ln.Ex.)	June, 1900	2·5	2·5	4 8½	92½ G	Nil	40	14	7	7	H.&V.Cp.	160	Dick, Kerr, & Co.
Llandudno and Colwyn Bay ..	Oct., 1907	8·37	13·60	3 6	90 G	11·5	45	18	*	..	..	..	Bruce Peebles & Co.
Llanelly and District	July, 1911	6·25	6·75	4 8½	90 G	11·2	60	12	*2	2	Trip.Ex.	..	British T-H.
London County Council (2) ..	May, 1903	148·56	287·35	4 8½	105 G	10·6	45	1725M 150T	8	8	V. Cp. C. Turbine	43,000	Dick, Kerr, & Co. / Westinghouse
London United Tramways Co. ..	April, 1901	55·25	102·45	4 8½	92½ & 100 G	18	28	339	7	5	V. Cp.	3,500	British T-H. / Westinghouse. / Blackwell & Co.
Lowestoft Corporation	July, 1903	4·75	5·07	3 6	100 G	27	36	19	*5	5	Cp.	..	Blackwell & Co.
Luton Corporation Tramways (Leased to J. G. White & Co., Ltd.) ..	Feb., 1908	5·25	6·25	4 8½	95 G	11	35	12	*1	1	..	..	J. G. White & Co. / British T-H.
Maidstone Corporation	July, 1904	5·5	7·04	3 6½	96 G	9	35	19	3	3	..	750	Dick, Kerr & Co.
Manchester Corporation	June, 1901	120·05	244	4 8½	105 G	14·9	35	685	*22	22	Turb'nes	45,300	British T-H. / Dick, Kerr, & Co.
Mansfield and District Co. ..	July, 1905	10	12·25	4 8½	90 G	17	50	24	*3	3	..	..	
Merthyr	April, 1901	3·69	4·81	3 6	96 G	11	66	16	*4	4	H.S.V.	..	D. K. & B. T-H
Metropolitan Electric Trys., Ltd.	July, 1904	56·25	112·5	4 8½	100 G	12	40	312	5	5	1 Stm. Tur	..	British T-H. / Brush Co.
Mexborough & Swinton Trys. Co.	Feb., 1907	7·75	10·75	4 8½	90 G	8·5	55	20	4	4	Turb.	700	Brush & B.T-H.
Middlesbro', Stockton, & Thornaby Electric Tramways Co.	July, 1898	10·5	15·825	3 6	92½ G	17	35	60	3	4	H.&V.Cp.	900	British T-H. / Blackwell & Co.
Middlesex County Council ..	Aug., 1904	25·5	51	4 8½	..	..	..	..	..	..	..	..	
Middleton Corporation	March, 1902	2·5	5	4 8½	..	..	..	..	..	..	..	..	
Middleton Electric Traction Co. ..	March, 1902	8·5	10·53	4 8½	90 G	15	49½	28	3	3	..	500	Glover & Co.
Morecambe	Jan., 1912	1·20	..	4 8½	96 G	18	..	4	..	..	..	..	
Musselburgh and District ..	Dec., 1904	6·5	8·125	4 8½	90 G	34	45	16	4	3	..	400	B. T-H. Co., Nat. Elec. Cons. Co.
Nelson Corporation	Feb., 1903	2·74	3·86	4 0	106 G	11	41	11	*4	4	..	400	Blackwell & Co. / British T-H. Co. / Brush Co.
New St. Helens & District Trys. Co.	July, 1899	18	20	4 8½	95 G	13	35	36	*4	4	V. Cp. C.	..	Westinghouse / British T-H.
Newcastle Corporation	Dec., 1901	32·75	62·875	4 8½	101 G	11	37	220M 2 T	6	6	V. Cp. Trip. Ex. & Turb.	11,000	Westinghouse / British T-H.
Newport (Mon.) Corporation ..	April, 1903	7·5	14·35	4 8½	98 G	10·5	40	44	5	5	V. Cp.	1,750	Westinghouse
Northampton Corporation	July, 1904	6·5	11·16	3 6	90 & 96 G	18	50	33	4	4	V.C.C.&T	1,020	Dick, Kerr, & Co. / Brush Co.
North Shields Tramways Co. ..	March, 1901	..	7·75	3 6	90 G	10	36	22					
North Staff. Trys. (*vide* Potteries)													
Norwich Electric Tramways Co. ..	July, 1900	14·5	19·25	3 6	65½ & 90 G	12·6	38	42	6	5	H.TCp&T	1,000	Westinghouse / Blackwell & Co.
Nottingham Corporation	Jan., 1901	21·5	41·5	4 8½	107 G	11·5	40	155	*3	3	..	..	British T-H. / Dick, Kerr, & Co.
Nottinghamshire & Derbyshire Tramways Co.	Aug., 1913	12·8	16·10	4 8½	G	..	..	24	*	..	..	..	British T-H.
Oldham, Ashton & Hyde Trys. Co.	June, 1899	9·12	11·75	4 8½	97 G	11	28	46	*3	3	V. Cp. C.	..	British T-H.
Oldham Corporation	Dec., 1900	24	37	4 8½	100 & 105 G	10·5	40	109	*4	4	..	2,220	Dick, Kerr, & Co.
Paisley & District Tramways Co.	June, 1904	18·25	32·50	4 7½	90 G	10	34	60	..	..	..	..	British T-H.
Perth Corporation	Oct., 1905	4·846	6·75	3 6	90 G	16	25	12	5	5	Cp.	500	Blackwell & Co.
Peterborough Elec. Traction Co. ..	Jan., 1903	5·33	6·71	3 6	94 G	31	35	14	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co
Plymouth Corporation	Sept., 1899	7·75	15	3 6	92 G	9	35	42	3	3	V. Cp.	..	Elec. Cons. Co. / Westinghouse
Plymouth, Stonehouse, and Devonport	Nov., 1901	1·5	3·62	3 6	84 G	11	34	15	..	..	..	..	Blackwell & Co. / Dick, Kerr, & Co
Pontypridd Urban District ..	March, 1905	5·5	8·6	3 6	96 & 100 G	10	27·6	26	4	5	V.C.Cp.	450	B.I.W. & B.T-H. / Blackwell & Co.
Portmadoc & South Snowdon Rly.	Under cons.	13·25	15	1 11½	41	28	200	6	..	..	..	..	
Portsdown & Horndean Tramway	March, 1903	6	7·5	4 7½	96 G	16	40	16	2	2	Oil	200	Dick, Kerr, & Co. / Brush Co.
Portsmouth Corporation	Sept., 1901	17·65	34·63	4 7½	96 & 100 G	17	35	100	5	4	V.& H.Cp.	2,075	Macartney & Co. / Dick, Kerr, & Co.
Potteries Electric Traction Co. ..	May, 1899	31·67	41·48	4 0	87, 90, 100, & 110 G	11	45	110	8	8	H.Cp. / V.Cp.	2,275	Dick, Kerr, & Co. / Blackwell & B.T-H.
Preston Corporation	June, 1904	10·54	17·2	4 8½	B.S.S. No. 2	16	28	39	2	2	H. Cp.	600	Dick, Kerr, & Co.
Radcliffe Urban District ..	April, 1905	5	6·5	4 8½	100 G	15	40	..	*4	4	V. Cp.	600	Mather & Platt
Rawtenstall Corporation	May, 1909	12	15·9	4 0	100 G	15	38	24	*3	3	..	850	Westinghouse
Reading Corporation	July, 1903	7·44	13·175	4 0	96 G	16	35	36	4	4	V. Cp.	400	Blackwell & Co. / Dick, Kerr, & Co / Westinghouse
Rhondda Tramways Co.	July, 1908	21	28·75	3 6	95 G	9	38½	54	7	4	Trip.Ex.	1,230	British T-H. / Brush
Rochdale Corporation	May, 1902	19·58 (A)	22·74 (A)	4 8½	103½ G	11·7	30	69	*	..	..	..	British T-H. / Dick, Kerr, & Co / Brush Co.
Rotherham Corporation	Jan., 1903	10	12	4 8½	100 G	9·5	45	36	*6	6	H.S.Cp.	1,485	Dick, Kerr, & Co.
Rothesay	June, 1902	4·81	9·68	3 6	94 G / 77 G	24	34	20	3	3	V. & Oil	350	Dick, Kerr, & Co.
Ryde Pier, Isle of Wight Ryde Pier Co. (3) ..	March, 1886	·5	1	4 8½	30 & 34 V	..	..	4	2	2	Gas	..	Westinghouse / Siemens Bros.
Salford Corporation	Oct., 1901	41·90	75·79	4 8½	103 G	20	42·5	220	*7	7	C. & Turb.	3,000	Westinghouse / Mather & Platt
Scarborough Tramways Co. ..	May 1904	5	7·75	3 6	90 G	10·5	35	22	2	2	Stm. Turb.	..	Brush & B.T-H.
Sheerness and District	April, 1903	2·5	2·704	3 6	94 G	43	40	8	6	5	V.Cp.C.	100	Siemens & Halske / Brush Co.
Sheffield Corporation	Sept., 1899	40	77·84	4 8½	110 & 120	9·5	35	339	..	..	..	..	British T-H

* Current from combined lighting and traction station. (1) G.B. surface contact system. (2) Mainly Conduit system, but there are now several Trolley lines.
Besides the electric lines the London County Council has also 4·45 route miles of horse tramways. (3) Third rail system. (A) Not including 17·1 miles track leased.
M—Motor Cars. T—Trail Cars.

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ELECTRIC TRAMWAYS (contd.).	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	No. of Engines.	Type of Engines.	Total Capacity Traction, kw.	Principal Contractors for Electrical Equipment.
				ft. in.	lbs.	1 in	ft. rad.						
Shipley Urban District	May, 1902	6	10	4 0	98 G	15	..	..	6	6	Turbine	1,800	British T-H.
Soothill Nether U.D.C. & Dewsbury & Ossett Corporations ..	Nov., 1908	3·125	4·45	4 8½	90 G	13	50	8	*	..	..	..	Nat. Elec. Cons. Co.
Southampton Corporation	Jan., 1899	10·25	18·75	4 8½	{96 G & 105 B.S.No.4}	13	40	73	6	6	H. Cp.C.	1,000	Westinghouse
Southend Corporation	July, 1901	7·01	13·52	3 6	90 G	18	48	42	*6	7	V.Cp.	2,075	British T-H.
Southend Pier (1) Southend Corp.	Aug., 1890	1·25	1·25	3 6	60 G	Lev.	..	28	..	..	..	..	British T-H.
South Metropolitan Elec. Try. Co.	Feb., 1906	13·09	26	4 8½	95 G	16	42	51	*8	6	Stm Tbs	1,650	{Dick, Kerr & Co. Brush Co.
Southport Corporation (5)	July, 1900	13·5	10·75	4 8½	87 & 90 G	25	45	30	*3	3	H. Cp	600	Dick, Kerr, & Co.
Southport Electric Tramway Co...	July, 1901	8·17	12·52	4 8½	87 G	Nil	40	21	*				
Southport Pier	1905	..	·75	4 0	..	..	..	1 M 2 T	..	..	..	..	Westinghouse
South Shields Corporation ..	March, 1906	5·7	10·25	4 8½	95 G	15	35	40	2	2	V. Cp. C.	1,100	Dick, Kerr & Co.
South Staffordshire	Jan., 1893	16·90	26·87	3 6	97 & 90 G	17	46	46	3	3	C.H. Cp.	..	{Blackwell & Co. E. C. C.
Stalybridge, Hyde, Mossley, and Dukinfield	May, 1904	21·186	27·75	4 8½	99 G	9	27½	59	8	..	Turb.	1,000	Dick, Kerr, & Co.
Stockport Corporation	Aug., 1901	16	27·62	4 8½	96 G	10·8	35	50	*5	5	Cp.	1,000	Dick, Kerr, & Co
Sunderland Corporation	Aug., 1900	10·92	20·35	4 8½	96 G	12	36	70	*	..	..	936	Dick, Kerr, & Co.
Sunderland District Electric Trys.	June, 1905	14·27	15·97	4 8½	90 G	11	40	33	*	..	..	..	British T-H.
Sutton & Howth (G.N.R., Ireland)	June, 1901	5·3	6	5 3	72 B	16·7	300	11	3	3	V.Cp.	500	{British T-H. Westinghouse
Swansea Tramways Company ..	June, 1900	13·02	20·38	4 8½	84 & 86 G	14	45	75	3	3	H. Cp. C.	620	British T-H.
Swindon Corporation	Sept., 1904	3·7	4·4	3 6	105 G	14	37	12	5	4	..	600	Dick, Kerr & Co.
Taunton Electric Traction Co.	Aug., 1901	1·66	2	3 6	90 G	25	35	6	*	..	..	..	Blackwell & Co.
Torquay Tramways	April, 1907	9·76	17·04	3 6	90 G	10	31	33	*	..	..	..	British T-H.
Trafford Park Estates, Ltd. (Trys.)	July, 1903	2·5	2·75	4 8½	100 G	Nil	35	..	..	..	..	..	
Tynemouth and District	March, 1901	4·21	7·83	3 6	90 G	10	30	21	*3	3	..	..	Blackwell & B.T-H.
Tyneside Tramways & Tramroads Co.	Sept., 1902	10·97	16·23	4 8½	95 G	10	40	24	*				
Wallasey Corporation	March, 1902	12	20	4 8½	98 G	11	40	67	*1	1	Turbine	1,000	Blackwell & Co.
Walsall Corporation	Jan., 1904	13·5	19·5	3 6	90 & 92 G	18·5	32	39	*7	7	V & Tur.	2,490	British T-H.
Walthamstow U.D.C. Light Rly...	June, 1905	9·14	12·53	4 8½	100 G	18	40	38	*15	12	{Gas & Turb's}	1,560	Westinghouse
Walton-on-Naze Pier	Aug., 1898	·5	·5	3 6	36 V	..	..	3	3	2	..	100	{Blackwell & Co.
Warrington Corporation	April, 1902	6·5	9·6	4 8½	90 G	27	50	21	*6	6	V.C.	500	{British T-H.
Wemyss and District	Aug., 1906	7·5	13	3 6	{95 & 97 G}	18	85	17	3	3	2 V.Cp.	..	BrucePeebles&Co
West Bromwich Corporation ..	Dec., 1902	7	12·5	3 6	98 G	20	49	29	8	8	Turb'nes	750	{Dick, Kerr, & Co. B. I. W. Co.
West Ham Corporation	Feb., 1904	16·8	30·0	4 8½	100 G	18	40	118	*3	3	V.C.Cp.	1,500	Brush & B.T-H.
West Hartlepool Corporation ..	May, 1896	6·72	8.3	3 6	87 & 90 G	15	35	25	*	..	..	..	{Elec. Cons. Co. Dick Kerr & Co.
Weston-super-Mare	May, 1902	2·92	3·53	4 8½	90 G	25	40	12	5	4	Cp. & T.	..	{Blackwell & Co. British T-H. Brush Co.
Wigan Corporation	Jan., 1901	30·9	45·42	{3 6 4 8½}	105 G	12	45	73	*8	8	..	740	Blackwell & Co.
Wolverhampton Corporation (3) ..	April, 1902	13·5	22	3 6	91 G	15	37·5	52	*10	10	{H.&V.C. & Turb's}	2,900	{British T-H. Electric Cons. Co.
Wolverhampton District	Oct., 1900	15·51	22·72	3 6	90 G	20	40	30	*4	..	..	..	{B.I.W. & B.T-H. Westinghouse
Worcester Electric Traction Co. ..	Feb., 1904	5·86	8·58	3 6	94 G	13	45	15	*3	3	..	..	{Brush Co. Dick, Kerr, & Co.
Wrexham and District	April, 1903	4·44	6·16	3 6	96 G	9·11	50	10	*6	..	..	..	British T-H.
Yarmouth Corporation	June, 1902	10	14·4	3 6	90 & 95 G	27	48	35	3	3	Comp.	..	{Brush Co. B.I.W. Co.
York Corporation	Jan., 1910	6	9·9	3 6	100	18	40	8 M. 4 T.	*8	8	V.C.	..	{Dick, Kerr, & Co. Brush & B.T-H.
Yorkshire (West Riding)	Aug., 1904	24·69	40·382	4 8½	96 G	15·5	40	69	9	6	..	1,800	Dick Kerr & Co.
Yorkshire Woollen District ..	Feb., 1903	22·25	36	4 8½	{94 & 100 G}	8	30	69	*	..	..	..	{Brush Co. Dick, Kerr, & Co.
RAILWAYS.													
LONDON AND VICINITY:													
Central London Rly. Co. (1) ..	July, 1900	6·5	13	4 8½	100 V	30	..	68 M. 172 T.	6	6	H. Cp. C.	..	British T-H
City & South London Rly. Co. (1	Dec., 1890	7·25	14·75	4 8½	{60 V 80 V}	30	120	52 L. 142 T	(a)	..	..	..	{Mather & Platt. Elec. Cons. Co.
East London Railway (2) ..	April, 1913	5·75	11·5	4 8½	90 B	..	..	(c)	..	..	..	..	British T-H.
Gt. Northern & City Rly. Co. (2)	Feb., 1904	3·5	7·75	4 8½	85 V	52	660	35 M 45 T	6	..	..	..	British T-H.
Great Western Railway .. (Hammersmith and City line.)	Nov., 1906	4·9	10·5	4 8½	97½ B	60	400	40 M. 80 T	10	10	V.Cp.	..	{British T-H. Elec. Con. Co.
London & North Western Rly. (Euston-Watford line in progress) (2)	May, 1914	41·5	80	4 8½	..	..	..	..	..	..	Turbine	..	{Siemens Works Westinghouse
London & South Western Rly. (Extensions in progress) (1)	Under cons.	47	150	4 8½	..	..	168	84	..	..	Turbine	..	{Dick, Kerr & Co. British T-H Westinghouse
London, Brighton, and South Coast Railway (4) .. .. (Extensions in progress)	Dec., 1909	22	70	4 8½	..	..	..	16 M. 8 T.	*(d)	..	..	..	{British T-H. Blackwell & Co.
London Electric Railway Co.: Baker St. & Waterloo Ry. (2)	March, 1906	7	14·0	4 8½	90 B	60	330	86 M. 72 T.	(a)	..	..	..	{Westinghouse British T-H.
Charing Cross—Hampstead Railway (2)	June, 1907	8	16·5	4 8½	90 B	33	330	60 M. 90 T.	(a)	..	..	..	{Westinghouse British T-H.
Great Northern, Piccadilly & Brompton Rly. (2)	Dec., 1906	9·25	18·5	4 8½	90 B	33	330	72 M. 144 T.	(a)	..	..	..	{Westinghouse British T-H.
Metropolitan Railway (2) ..	Jan., 1905	26	59	4 8½	86 B	44	363	86 M. 172 T	4	4	Turbine	..	{Westinghouse British T-H.
Metropolitan District Railway (and running powers) (2)	July, 1905	41	80·46	4 8½	86 B	40	330	234 M. 286 T.	(a)	..	Turbine	..	{British T-H. Westinghouse
Waterloo and City Rly. (1) ..	Aug., 1898	1·5	3	4 8½	87 B	30	321	17 M. 12 T.	6	6	V. C.	..	{Siemens Bros. Dick, Kerr & Co.
PROVINCES:													
Lancashire and Yorkshire (2) .. (Extensions in progress)	March, 1904	43	85	4 8½	86 B	85	840	88 M. 52 T.	6	5	{1 V.C. 4 H.C.}	..	Dick, Kerr, & Co.
Liverpool Overhead Rly. Co. (1)	March, 1893	6·5	13·05	4 8½	60 V	40	429	46 M 7 T	7	7	{H.Cp. V.Cp.}	..	{Electric Cons. Co. Dick, Kerr, & Co.
Mersey Railway (1)	April, 1903	4·5	9	4 8½	86 B	27	528	24 M. 87 T.	5	5	V.Cp.	..	{Westinghouse Elec. & Mfg. Co
Midland Rly.—Morecambe and Heysham Branch (4)	June, 1908	9·75	19·5	4 8½	..	..	..	8 M. 6 T.	4	4	Gas.	..	{Westinghouse Siemens Bros.
North Eastern Railway (1) ..	March, 1904	35	80	4 8½	90 B	55	792	60 M. 50 T.	(b)	..	..	..	British T-H. Co.

*Power from combined lighting and power station. (1) Third rail system. (2) Third and fourth rails system. (3) Lorain surface contact system. (4) Single phase.
(5) Not including 9 miles owned but leased. (a) Power supplied by Chelsea Power Station (80,000 H.P.) (b) Power purchased from the Newcastle-upon-Tyne Electric Supply Company, Limited.
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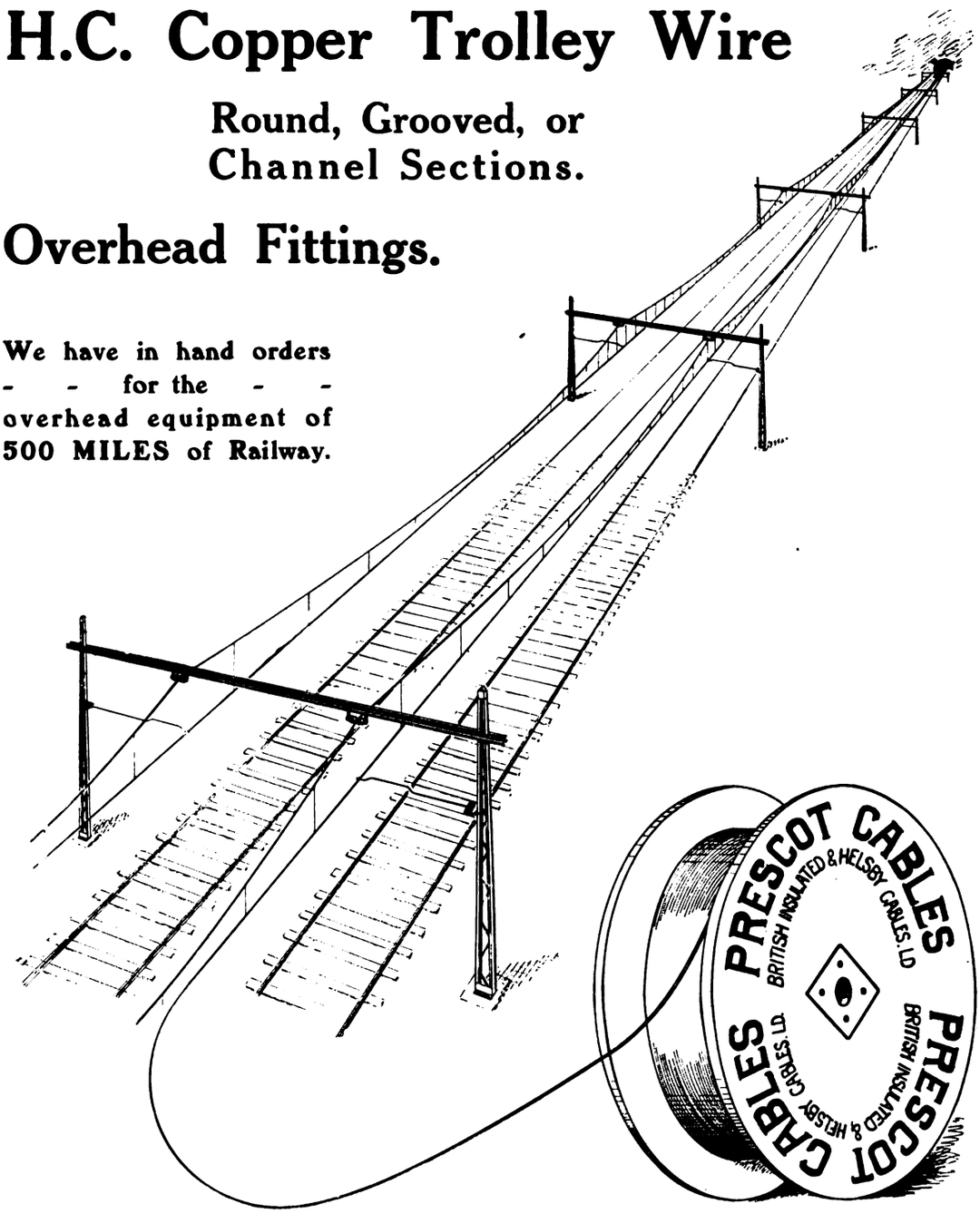

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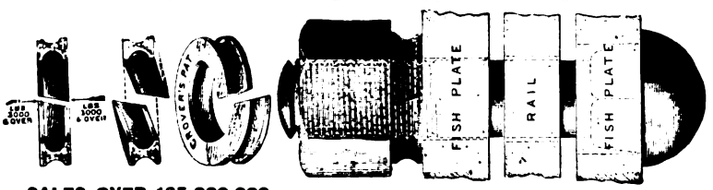

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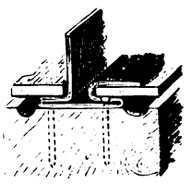

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, JUNE 8, 1916. VOL. XXXIX.

NORTH EASTERN RAILWAY ELECTRIFICATION.

EQUIPMENT OF THE SHILDON-NEWPORT MINERAL BRANCH.

The North Eastern Railway Company was one of the first main line British railways to adopt electric traction, for as far back as 1904, when Sir George Gibb was general manager, the company successfully applied electrical operation to their Newcastle and Tyneside suburban traffic. Once more this company has acted as a pioneer of electric traction in applying it to heavy freight haulage. In 1911 the general manager, Sir A. Kaye Butterworth, instructed their consulting electrical engineers, Messrs. Merz and McLellan, to report generally on the question of electrification with reference to the special conditions of the North Eastern system. The company's chief mechanical engineer, Mr. Vincent Raven, visited the United States with Mr. Merz in 1911, and on their return the directors decided to proceed at once with a preliminary scheme.

The Shildon-Newport route, an important freight line dealing almost exclusively with heavy mineral traffic, was selected for trial, and its electrification was so far completed by July 1, 1915, that a limited service was begun. At the present time a night service is in operation, work on the completion of the overhead equipment being carried on by day.

Some historical interest attaches to the route, since the track runs over a portion of the original Stockton to Darlington Railway, the first public railway on which steam locomotives were used for conveying passengers and goods. This line was opened in 1825, and two of the original locomotives designed by George Stephenson are to this day preserved in the Darlington Station of the N.E.R. The fact that the first trial in England of electrification for heavy freight haulage on a large scale should be carried out on this particular route is noteworthy.

Beyond the usual considerations affecting the decision to apply electric traction to such a line, there was a special factor which differentiated the North

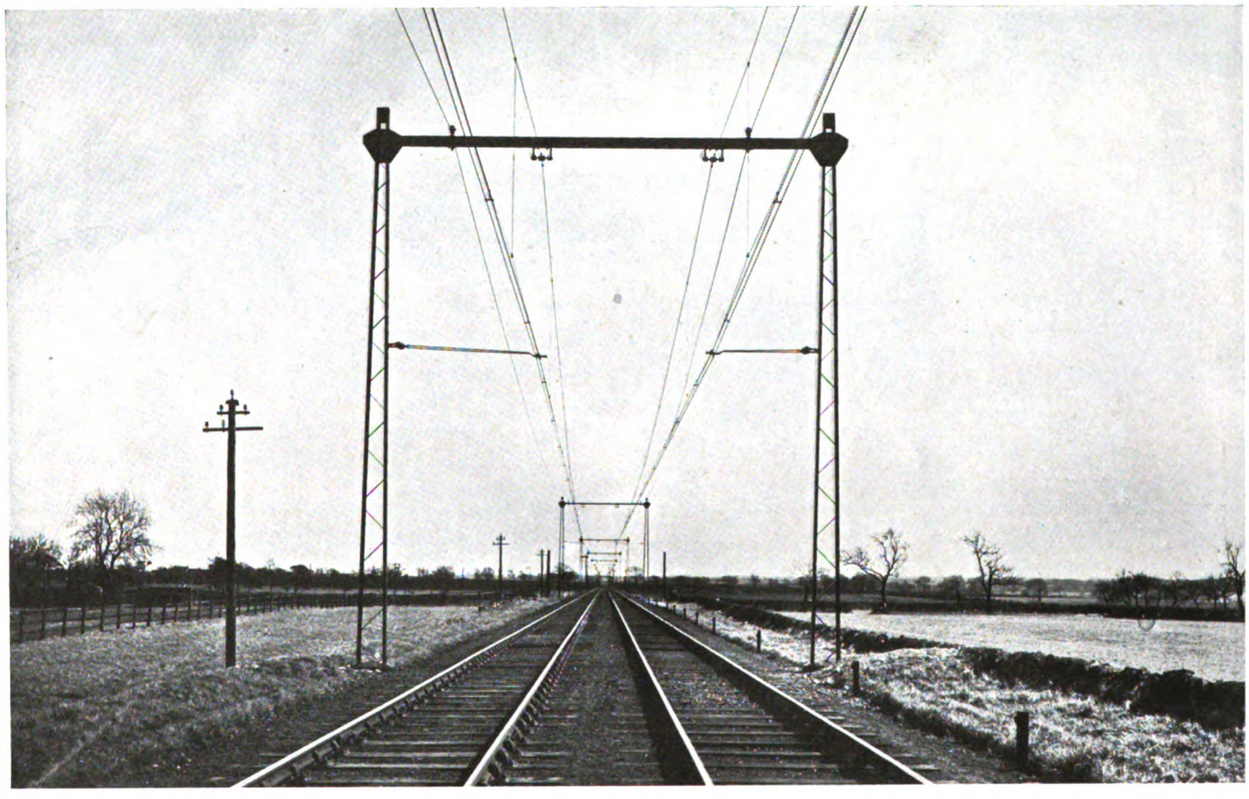

Fig. 1.—General View of Overhead Equipment—Shildon-Newport Line, North Eastern Railway.

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Eastern Railway lines from others in the United Kingdom. As is well known, the production and distribution of electric power has been developed upon a larger scale on the North East coast than in any other part of this country, and a large proportion of the power is derived from electric generating stations using as fuel the waste heat and gases derived from coke ovens and blast furnaces in the Durham and the Cleveland districts. An ample supply of cheap electrical energy was therefore available from the systems of the existing power companies, and this fact, obviating as it does the necessity for a large capital expenditure by the railway company on power station plant, had an important bearing on the whole scheme.

The electrified line, of which a typical view is given in Fig. 1, has a route length of between 18 and 19 miles, and connects the mineral sidings at Shildon, which form one of the largest marshalling yards in Great Britain, with the Erimus sidings at Newport, near Middlesbrough. A considerable portion of the sidings at both ends is also electrified, so that, including the sidings, about fifty miles of single track are equipped for electric working.

The route now electrified is shown in Fig. 2. As will be seen in Fig. 34, the ruling gradient is in favour of the laden traffic, the steepest gradient being 1 in 103. The line carries the heavy mineral traffic from the South West Durham coalfields to the Middlesbrough district, supplying the large number of blast furnaces and ironworks concentrated there. On the return journey the load consists mainly of empty wagons returned to Shildon sidings.

Overhead Track Equipment.

It was decided to adopt the high tension direct-current system, energy being supplied to the locomotives through overhead contact wires at a pressure of 1,500 volts from the two rotary-converter substations described later. The overhead track equipment was carried out under the supervision of the railway company's then chief engineer, Mr. C. A. Harrison.

Figs. 1, 3 and 4 show the type of catenary construction adopted. The overhead contact wires on the main portions of the track consist of two hard-drawn copper conductors, each ·155 sq. in. section, but on certain portions of the sidings, where the loads are not so heavy, a single contact wire only is used. The wires are supported by a solid steel auxiliary catenary wire, to which they are attached by sliding clips. This auxiliary catenary is in turn suspended from the main stranded steel catenary by means of steel wire droppers. The main steel catenary wire is supported from the steel structures, shown in several of the accompanying views, by means of special insulators, double insulation being used throughout. The normal span between the steel structures is 110 yards, but on curves and sidings they are placed at lesser intervals depending on the conditions existing.

The normal height of the contact wire from rail level is 16 ft. 6 in., but at level crossings this is increased to 18 ft. 6 in., and under some of the low bridges, of which there are a large number on this route, the height from the rail level is reduced, the minimum height being about 13 ft. 8 in.

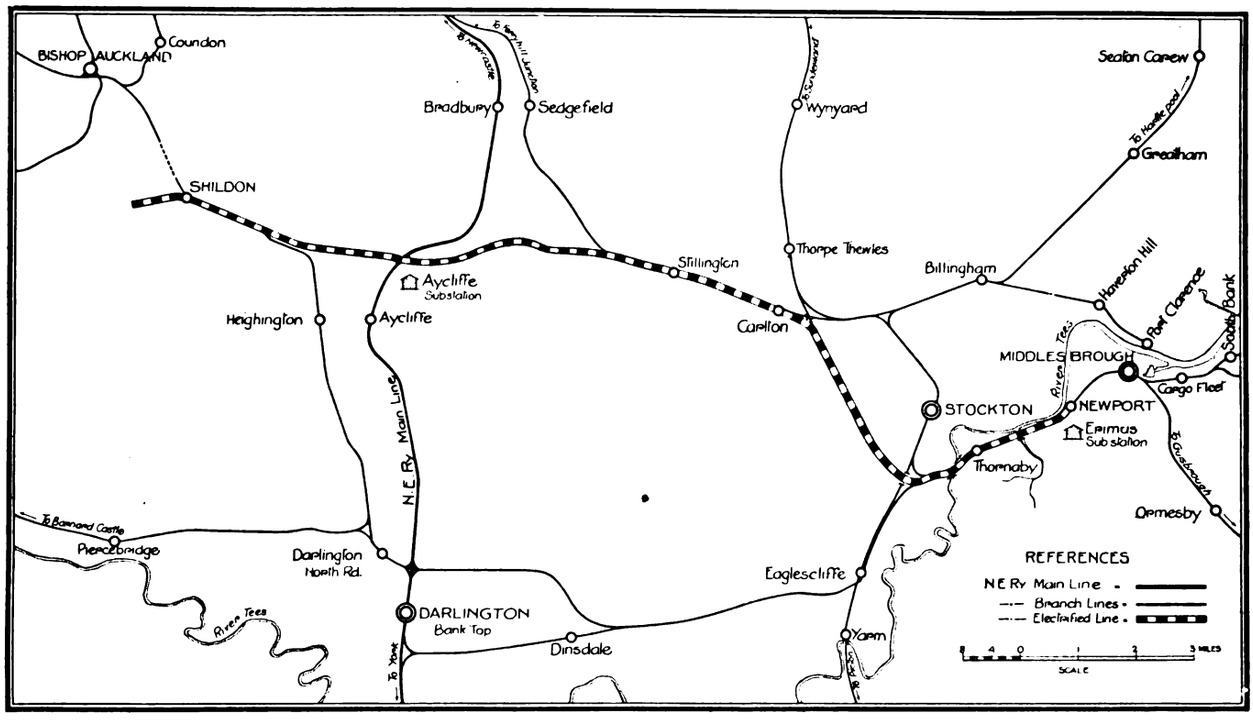

Fig. 2.—Map Showing Electrified Line from Shildon to Newport, North Eastern Railway.

Two auxiliary stranded copper feeder wires, one for each track, of ·194 sq. in. section, are carried on the top of the steel structures referred to, and are connected in parallel with the main contact wires at frequent intervals. The purpose of these feeder wires is to increase the conductivity of the overhead equipment.

Each steel structure carries a pair of insulated steadying arms (Figs. 3 and 4). These steadying arms are pivoted in all directions, and are attached to the contact wires by means of clips, their purpose being to fix the position of the contact wire relatively to the track. The contact wires are staggered in the usual way to prevent undue wearing of the bow collectors.

The general type of steel structure carrying the wires over straight parts of the track can be seen in Fig. 1. It consists of two steel masts and a cross girder, each of these being made up of two channels with flat steel bracing. On curves a centre strut, steadied by steel tie rods, is added, as shown in Fig. 4,

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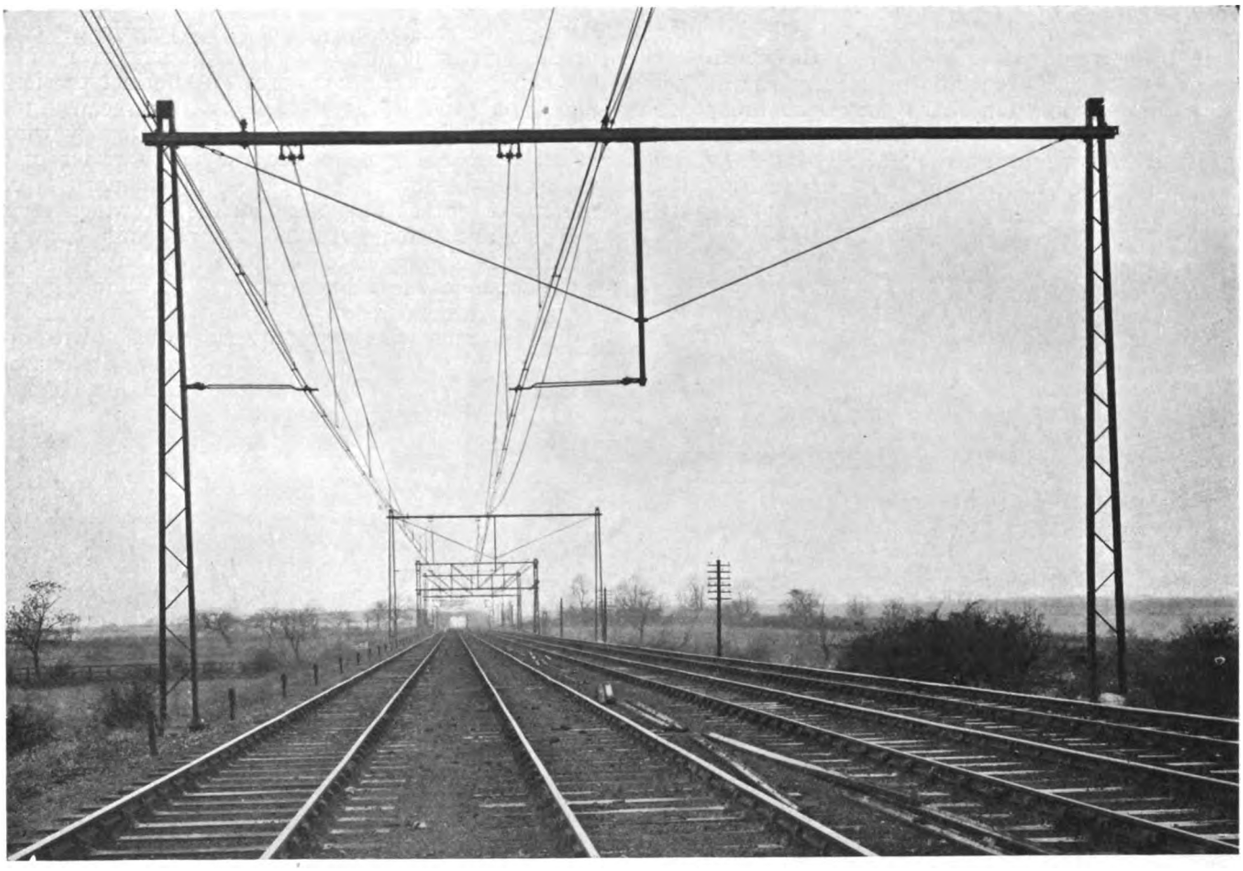

Fig. 3.—Gantries Spanning Four Tracks near Carlton Station.

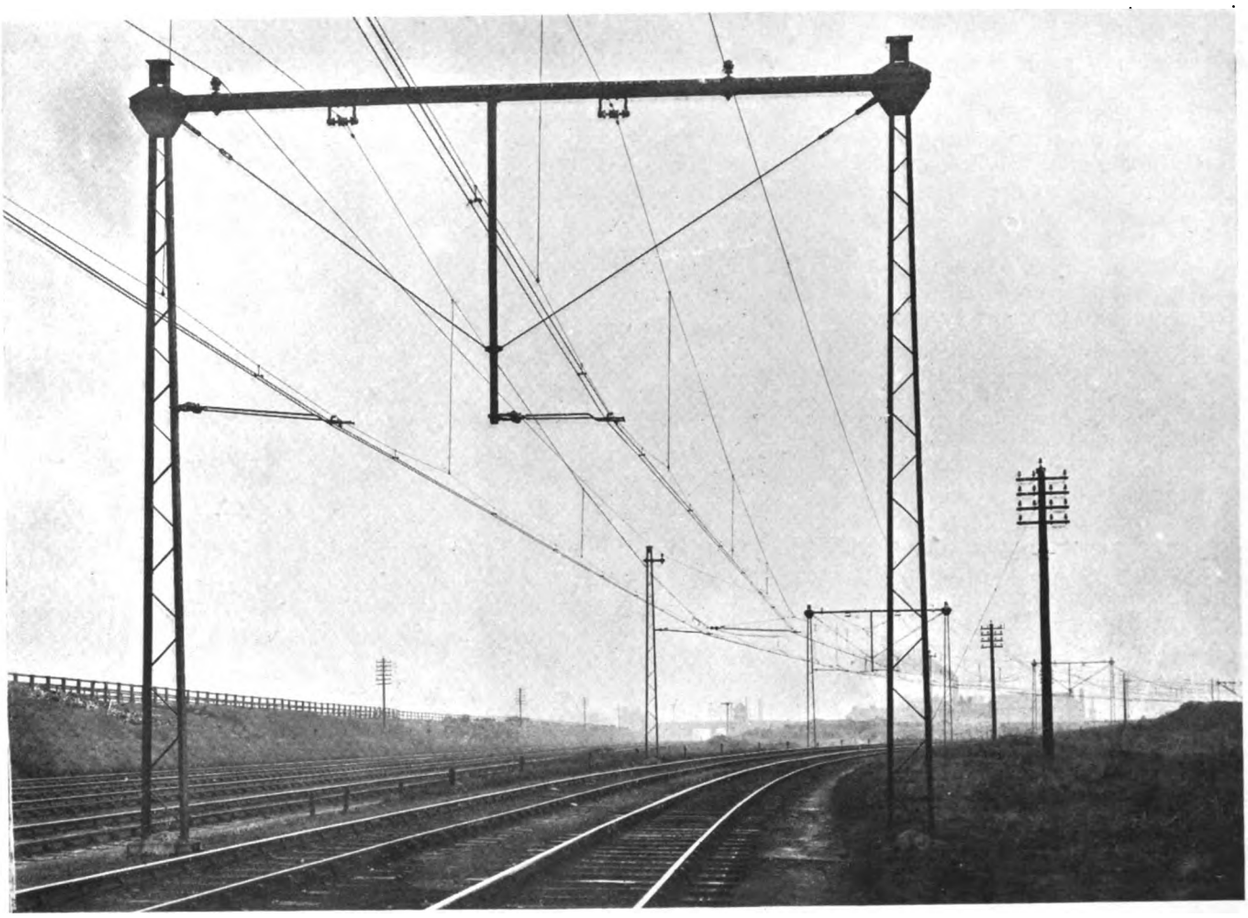

Fig. 4.—Overhead Construction at the Curve at Bowesfield Junction, Showing Use of Independent Pull-Off Mast.

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the steadying arm on the mast on the inside of the curve being removed and fixed to the centre strut mentioned, so as to ensure the steadying arm being always in tension. On sharp curves an independent pull-off mast is fitted where necessary, as illustrated in Fig. 4. A structure arranged to cover four tracks, also with a strut in the centre, is seen in Fig. 3. In

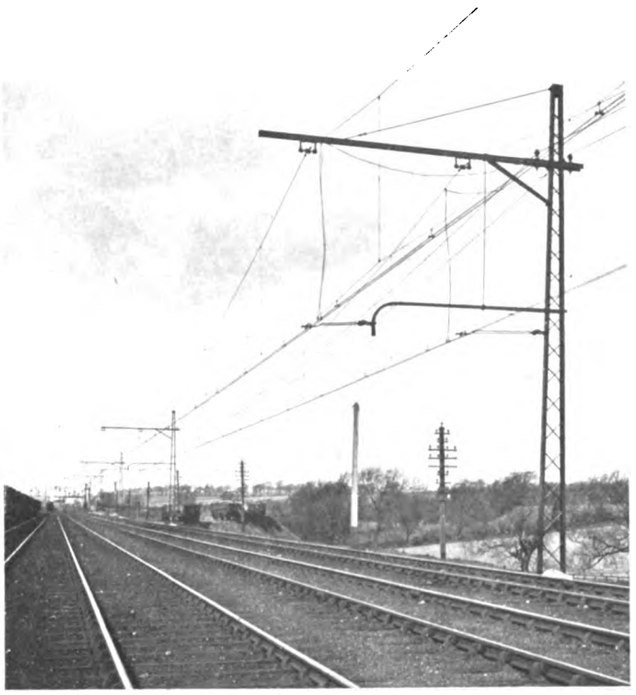

Fig. 5. Cantilever Construction over Two Tracks.

this case the purpose of the strut is to carry the steadying arm without a centre mast, while for the time being two tracks only are equipped.

In Fig. 5 an arrangement is shown of a two-track structure where it was impossible to erect two masts. Cantilever construction is here adopted, the general features of which can be seen in the illustration. A similar cantilever construction over a single track is illustrated in Fig. 6. In this case, it will be noted that wood poles were used, a short length of single track being equipped in this way for experimental purposes.

All steel structures carrying the overhead track equipment are bonded to the running rails by means of a hard copper bond of ·08 sq. in. section. Any steel structures carrying signals, which are in proximity to the electrical equipment, are also similarly bonded to the running rails.

In order to limit as far as possible the sag of the contact wires, due to temperature variation, automatic tensioning was adopted. The tensioning points are approximately 1,100 yards apart. Fig. 7 shows a typical tensioning structure. Two of these structures are placed 65 yards apart at the end of each tension length, the wires from the opposite lengths overlapping by this amount. The end of each contact wire is raised at the tensioning structure to which it is fixed to a height of about 18 in. clear of the normal level at that point, so that the locomotive bows ride gently and without shock from one tensioning length on to the next. The contact wires are anchored to the auxiliary catenary wire at a point two-thirds of the distance along each tensioning length in the running direction.

The tensioning structures consist of strong steel masts made up of four angle irons with angle iron bracing, and it will be seen from Fig. 7 that the structures are fitted with two cross girders with a centre strut. The tensioning weights are slung in the centre of the mast structures by chains passing over pulleys attached to the contact wires. A normal tension of about one ton is maintained by this means in the double contact wire. The auxiliary catenary wire is in all cases anchored off to the lower girder of the tensioning structure, but the main catenary is continuous except at tensioning points, at which section switches are fitted. At the latter points the main catenary is also anchored off, but to the top girder.

On some of the sidings where only shunting work is done, and the loads on the locomotives are not heavy, a single contact wire is used over each track with ordinary tramway span wire construction. An example is shown in Fig. 8 where such a construction spanning seven tracks can be seen.

On some of the marshalling and reception sidings, which are not equipped throughout, and on which it is only necessary for the overhead construction to permit of the locomotives entering to pick up their load, the wires are terminated as shown in Fig. 11. Danger boards are fitted, beyond which electric locomotives should not pass, but if by any chance they should over-run these, the terminal construction is such that no damage would be done to the bow collectors or to the overhead track.

Fig. 9 shows a typical low stone bridge of which, as previously mentioned, there are a large number on this route. At some of these bridges it is possible to carry the main catenary wire through the bridge, but at most of them it is necessary to anchor it off to the bridge. In these cases, in order to obtain the necessary clearance, the contact wires, together with the auxiliary catenary, are brought towards the centre of the bridge, so that contact is made towards the extreme end of the bow collector. In order to prevent the other end of the bow collector from striking the bridge, a guard wire is fitted. This guard wire is

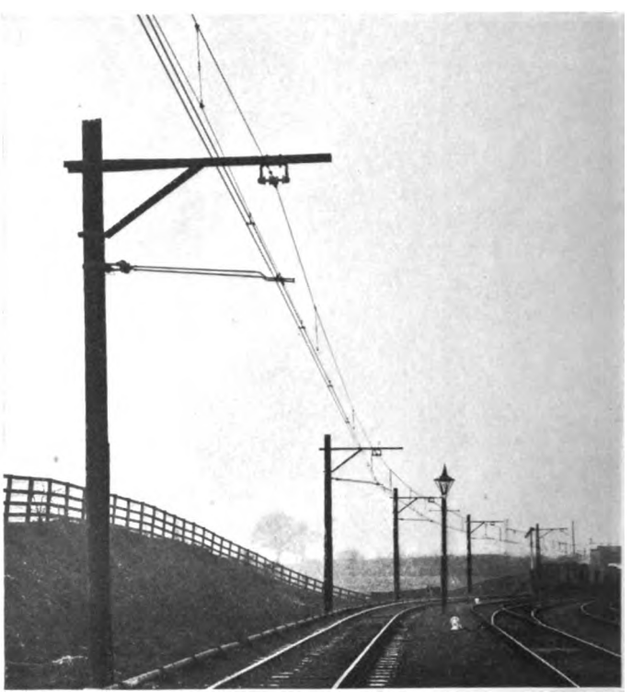

Fig. 6.—Cantilever Construction with Wooden Poles over One Track.

anchored off to the structures on either side of the bridge, and is only alive while a locomotive is passing underneath.

The track is sectioned on the normal length at intervals of about 2½ miles, and considerably more

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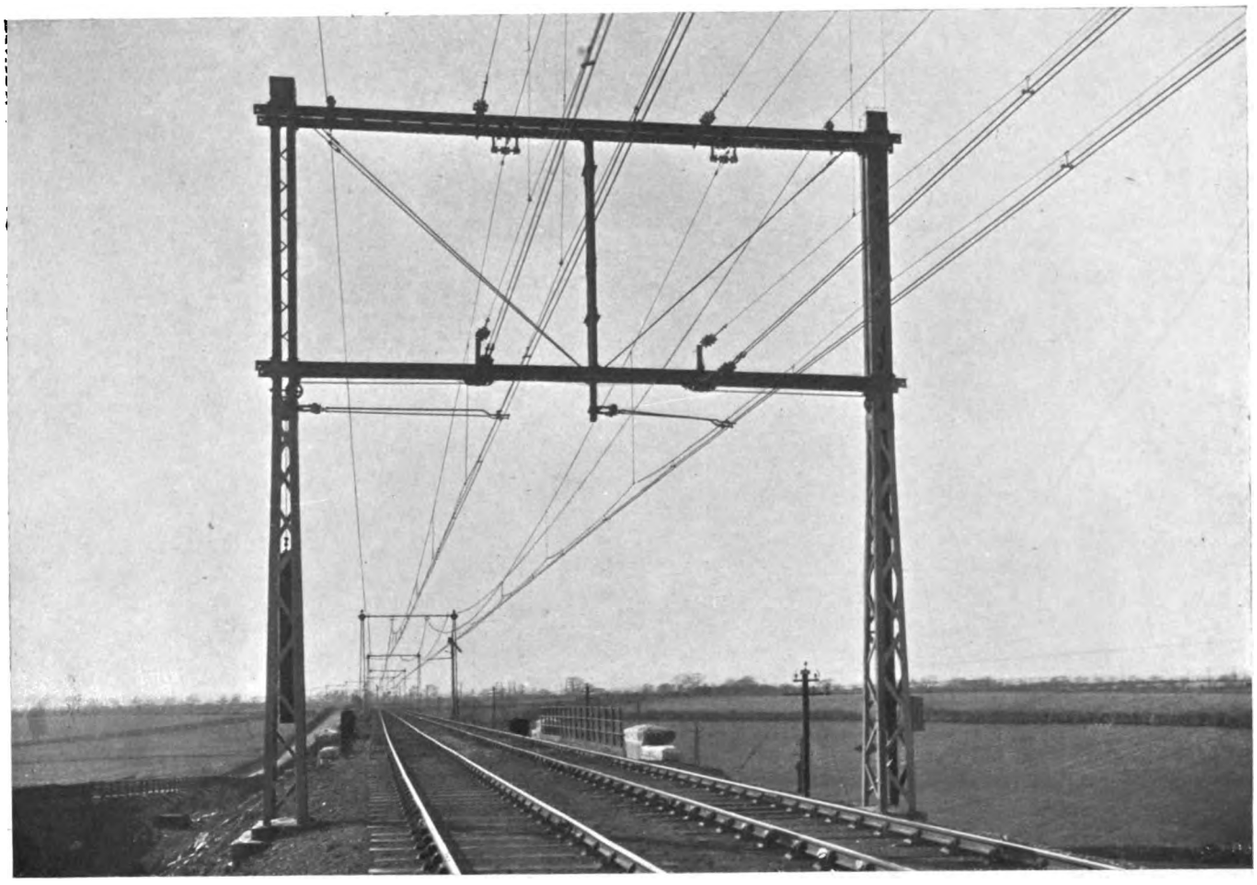

Fig. 7.—Typical Tensioning Structure.

frequently on sidings. Section points are arranged to occur in most cases at tensioning points so as to avoid the use of section insulators. The type of section switch adopted is illustrated in Fig. 12. These switches are fitted in the open, so that it is permissible to use the horn break arrangement which can be seen in the figure. They are erected on the uppermost cross girder of the section structures, and operated by levers in the signal cabin to which they are connected by the usual arrangement of railway point rods. Fig. 10 shows a view of five section switches fitted on a girder. Normally the tracks are coupled in parallel, but by means of the section switches the up and down tracks can be operated separately if desired.

As the train control system of working is in use on this route, the signal cabins are connected by telephone with a central control office situated at Newport, and the handling of these switches is directed from the

Fig. 8.—Span Wire Construction over Seven Sidings.

Fig. 9.—Method of Suspending Wires at Low Bridge.

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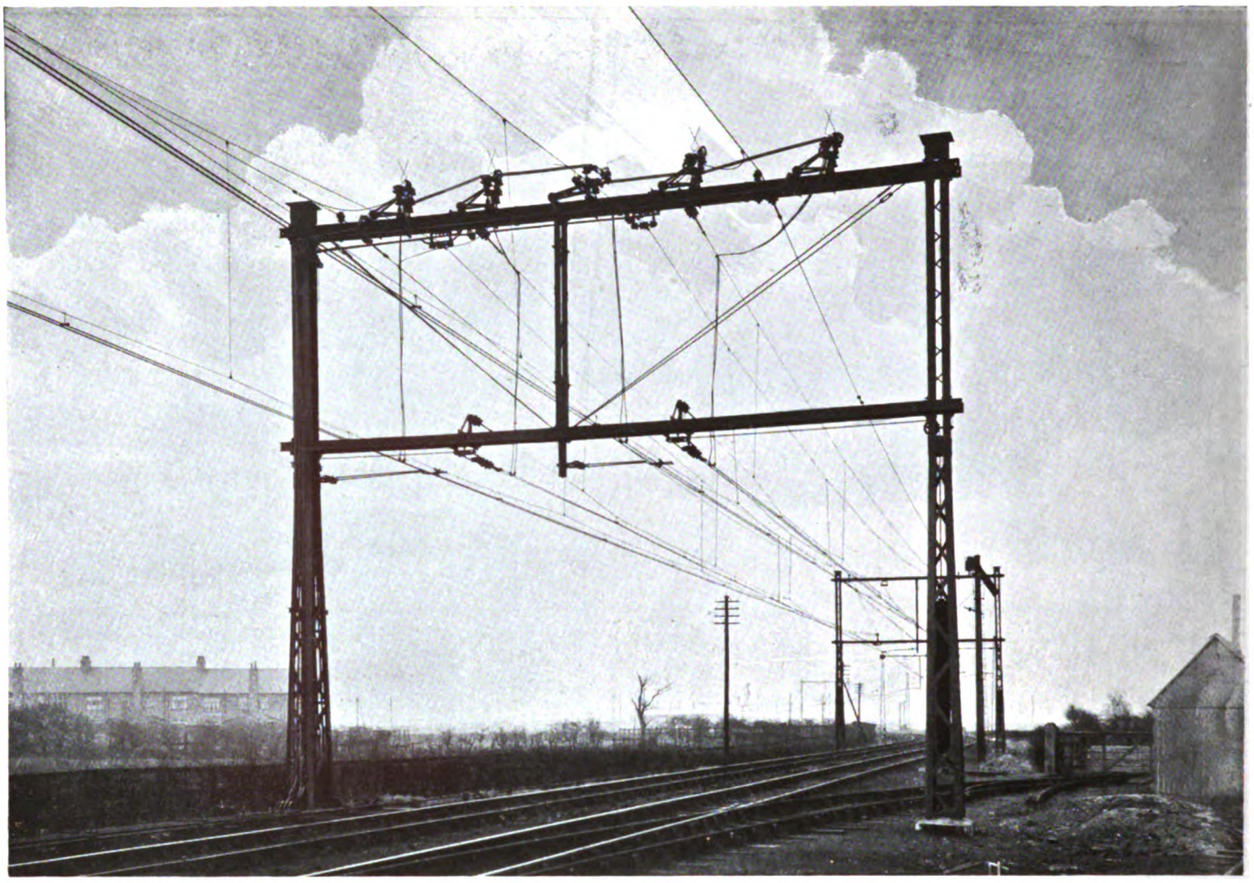

Fig. 10.—Five Section Switches, as illustrated in Fig. 12, Fitted on a Girder.

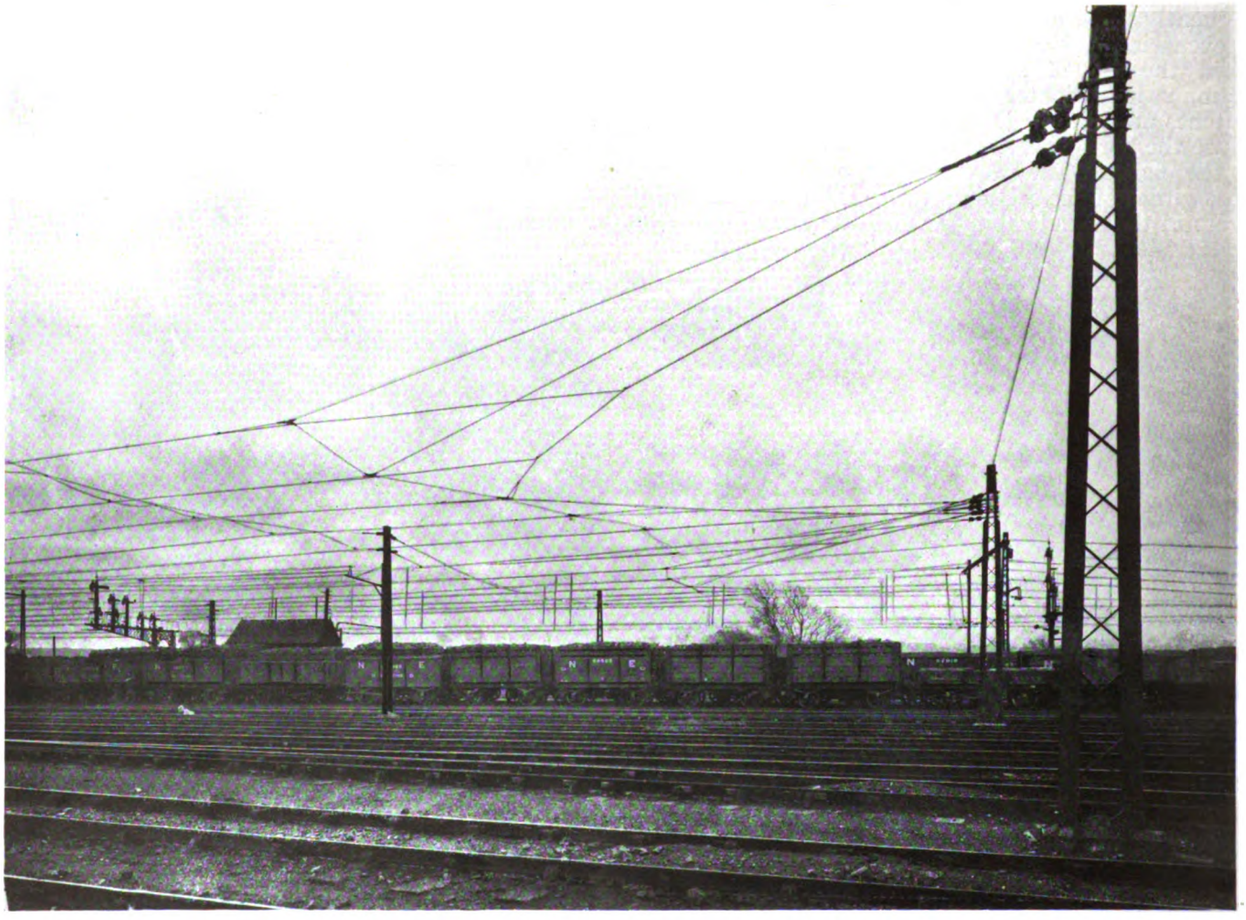

Fig. 11.—Overhead Wire Arrangement at Terminal.

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same point. In certain positions, such as at cross-overs and some of the sidings, where it was impossible to avoid their use, section insulators are fitted. The type of insulator is shown in Fig. 13. In all cases,

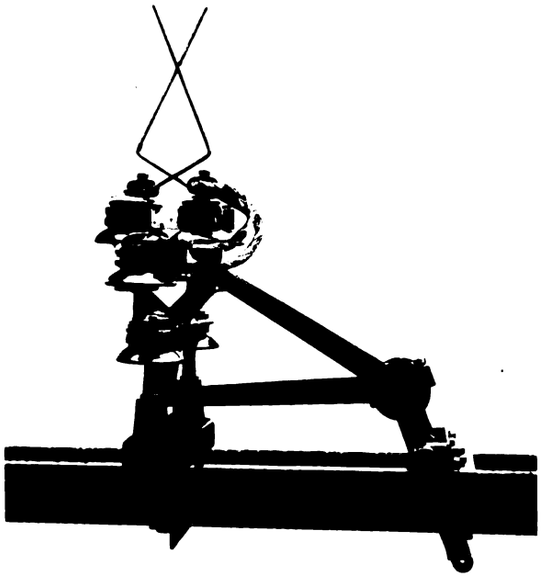

Fig. 12.—Section Switch.

however, these are fitted at points where the locomotives are travelling at low speed.

The track rails are bonded at the joints with stranded copper bonds fitted under the fishplates, two bonds each of ·109 sq. in. section being fixed at each joint. They are also cross bonded between the two rails at intervals of 300 ft., and between the two inner rails of adjacent tracks at the same interval, the bonds in the 6-ft. way being midway between those in the 4-ft. way.

Sub-stations.

As will be seen from Fig. 2, there are two rotary converter sub-stations converting the 3-phase 40-cycle high tension current as received from the power companies' system to direct current at 1,500 volts for the overhead wires.

The sub-station at Aycliffe, which externally is similar to that at Erimus, is shown in Fig. 14. The sub-station at Aycliffe contains two 800-kw. rotary sets, each set consisting of two 400-kw. rotary converters in series. The general arrangement of the sub-station is shown in Figs. 15, 16, and 17, and Fig. 21 gives a general view of the interior, in which a portion of the high tension A.C. switchboard can be seen. Fig. 22 gives a view of the D.C. switchboard.

It will be noticed in Figs. 21 and 22 that, this being a high tension sub-station, the machines are enclosed by expanded metal screens. The rotary converters were built by the British Thomson-Houston Company, Limited, and the transformers by the British Westinghouse Company. The rotaries are of the self-synchronising type, and are started by oil immersed drum type starting switches. The Erimus sub-station is generally similar, and two rotary sets are also fitted, but in this case one is of 1,200-k.w. capacity.

In designing the sub-stations it was necessary to decide whether the 1,500 volts should be generated in the armature of a single rotary or by connecting two rotary converters together in series to form one unit.

Fig. 14.—Aycliffe Sub-Station.

The scheme of connecting two rotary converters in series to generate 1,500 volts was eventually adopted, as it enabled the machines to be designed with a reasonable commutator speed and a very conservative value of voltage between commutator bars. The machines run at 800 revolutions per minute.

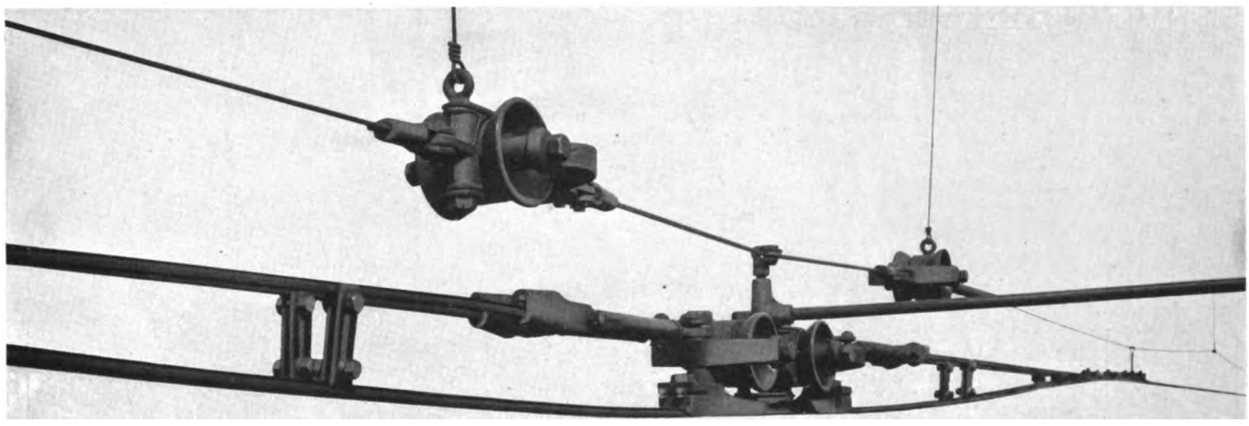

Fig. 13.—Type of Section Insulator.

They were designed and tested to operate normally at 95 per cent. leading power factor, and to withstand an overload of 50 per cent. for two hours, 100 per cent. for ten minutes, and 200 per cent. momentarily. They were subjected to a high potential test of 5,000 volts for five minutes.

On account of the high voltage on the commutator, these machines were specially designed to avoid

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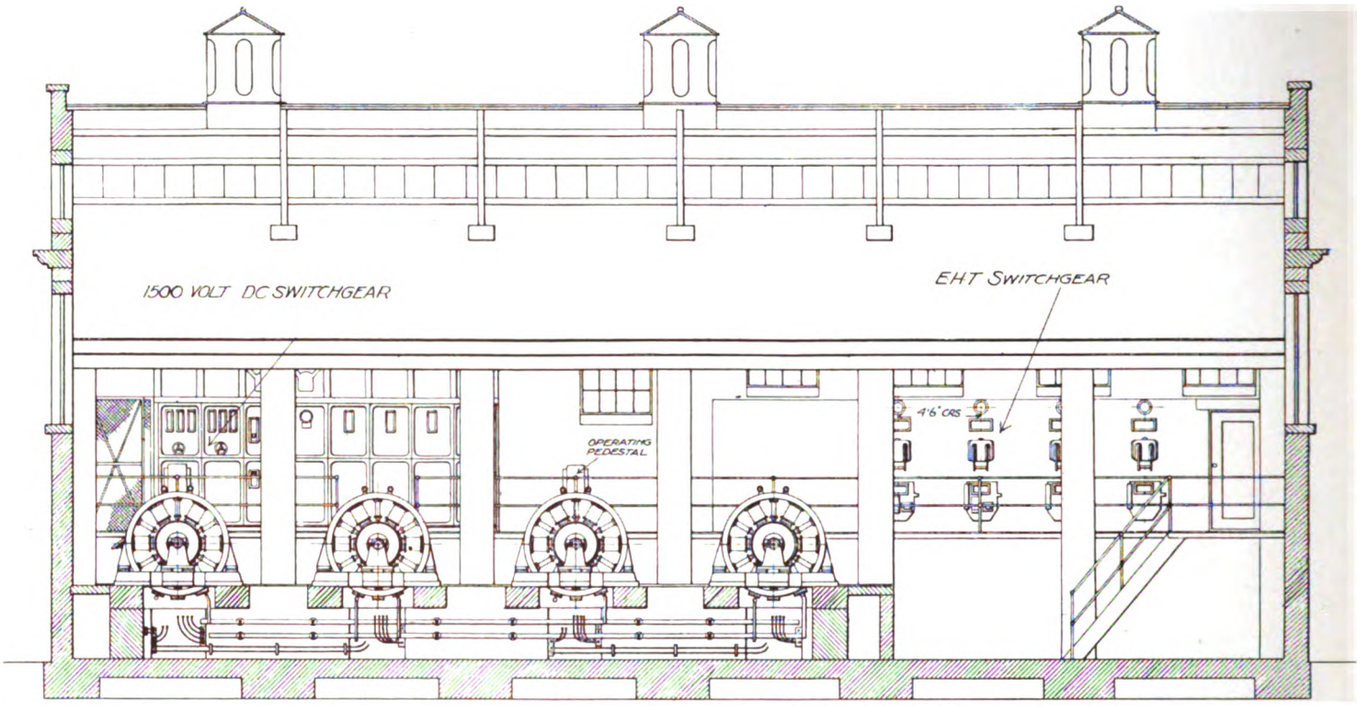
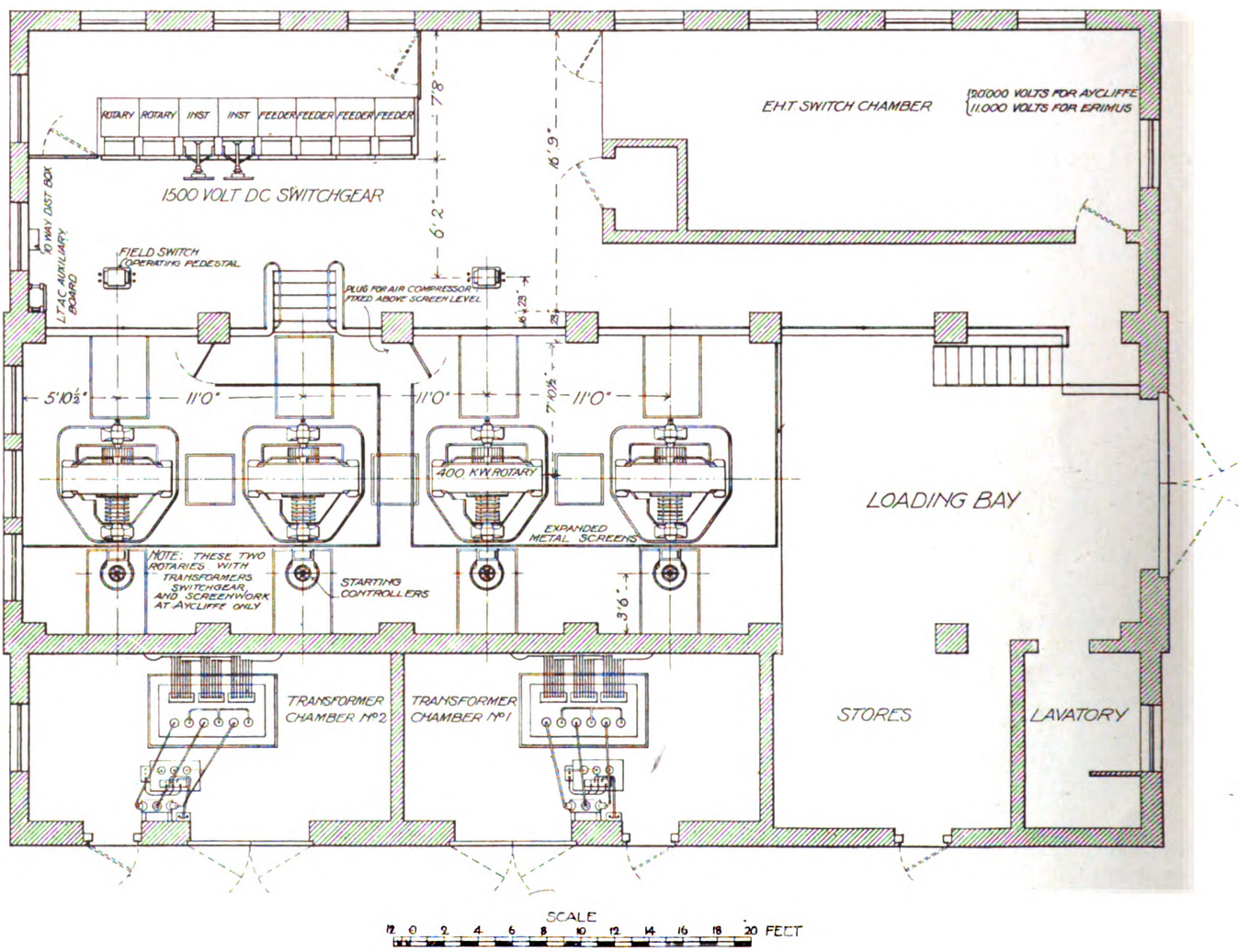


Longitudinal Elevation.



Plan.

Figs. 15 and 16.—Section and Plan of Aycliffe Sub-Station.

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damage due to flash over occasioned by short circuits on the system. The operating parts of the brush gear were entirely enclosed, the distance between brush arms was made as great as possible, and the commutator was completely screened by arc-proof insulating material from the armature and frame of the machine (Fig. 19).

other for supplying lighting and auxiliary power in the station for portable air compressors, etc.

The sub-stations are supplied with three-phase current from the interconnected mains system of the North East coast power companies through the Cleveland and Durham Electric Power Company. Aycliffe is supplied at a pressure of 20,000 volts between

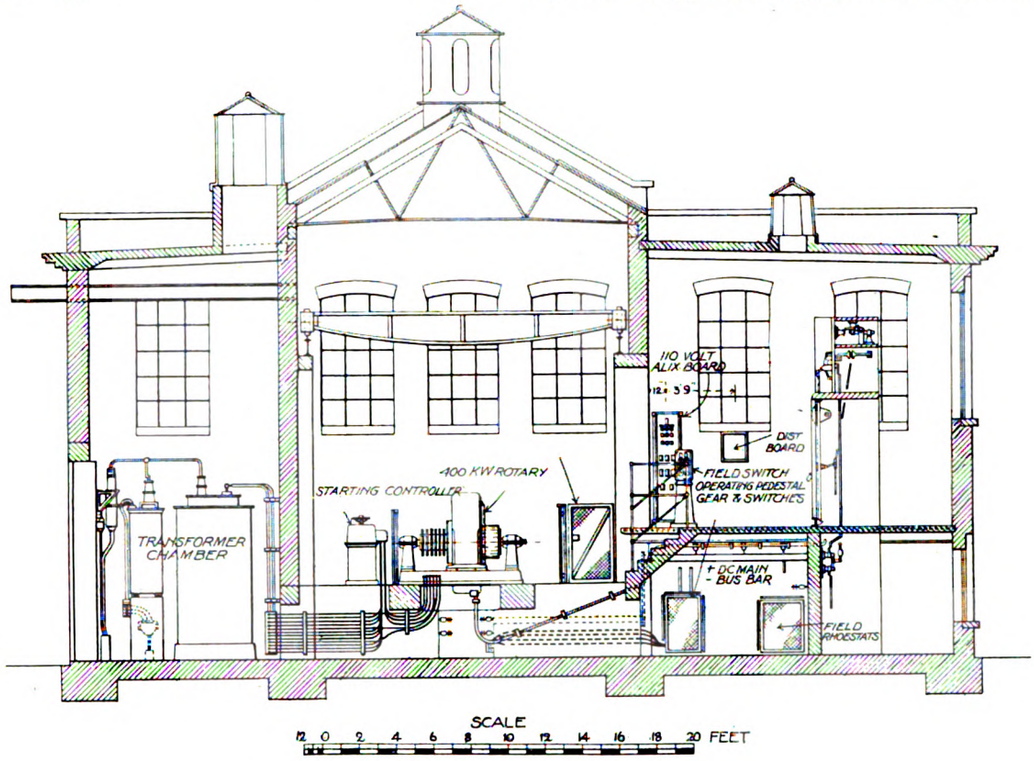

Fig. 17.—Cross Section of Sub-Station.

Tests were carried out to determine what load could be suddenly thrown on and off these sets without flashing. A load amounting to five times that of the full load was thrown on and automatically tripped off with a breaker seven times, and three times out of the seven the machines stood this severe test without flashing. Fig. 18 shows an oscillograph which was

phases through two overhead lines. The 20,000-volt switch gear is of the Reyrolle ironclad wall-operated type. The Erimus sub-station is supplied at a pressure of 11,000 volts between phases through underground cables connected to the power company's system in the Middlesbrough district, the alternating current switch gear being of the same type as that of Aycliffe

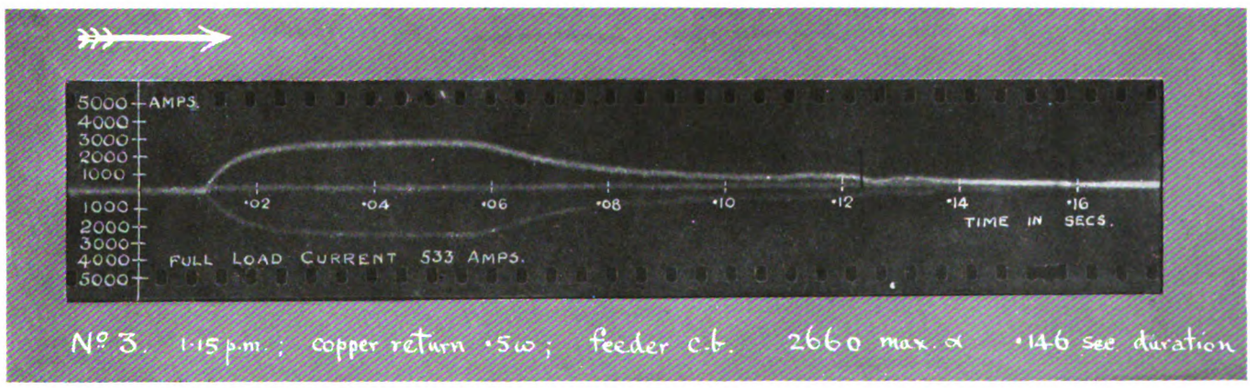

Fig. 18.—Oscillograph Record during Test of Rotary.

taken during one of the tests when the rotaries did not flash over.

Two auxiliary transformers are installed in each sub-station connected directly across the high tension terminals of the main transformers. A feature of interest in connection with these is the fact that they were fitted with a double secondary winding, one section being used exclusively for metering, and the

The direct current switch gear at both sub-stations is of the brick cell type. Fig. 20 shows a diagram of connections of Aycliffe sub-station, and along with this the following switch gear details will be useful:—

In each of the sub-stations the E.H.T. switch gear is of the ironclad compound-filled type, the ironclad gear being fitted in a special chamber on the switch-board

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gallery, with the control panels and instruments mounted immediately in front of same.

A special feature of the transmission scheme is the high-voltage D.C. gear. This switch gear has been designed somewhat on the lines of that usually adopted for high tension A.C. boards, that is to say, the apparatus is of the remote controlled type, and is mounted in cell structure built up of brick walls with moulded stone division slabs, each equipment being thus entirely separated from its neighbour.

The individual cells are built up on the cubicle system, that is to say, special compartments are provided for: (1) busbars and isolating switches (top cubicle), (2) circuit breakers (intermediate cubicle), (3) the bottom cubicle contains the operating mechanism for the isolating switches and circuit breakers, also the connecting cables passing up to the circuit breaker units. From this it will be seen that no H.T. gear is accessible below the circuit breaker cubicle. Further, when it is desired to work on the circuit breakers these can be entirely disconnected from the busbars by means of busbar isolating switches. The circuit breakers and busbar isolating switches are mounted on polished white marble panels built into the cell structure, suitable angle iron supports being provided for bolting into the brick division walls.

The busbar isolating switches are of the H.T. rotary type, that is to say, the contact units are mounted on porcelain insulators carried on moulded stone slabs forming part of the cell structure. The contact blades are fixed on porcelain insulators of the sleeve type, carried on a rotating shaft fixed to the cell structure by means of stout wrought-iron brackets.

The circuit breakers included in this scheme are specially designed for high voltage work, the break being exceedingly large and quick. The breakers are of the brush-contact type with auxiliary copper sparking tips, and special carbon blocks to take the final break. These blocks are designed with an ample margin of contact area, and in addition are fitted with magnetic

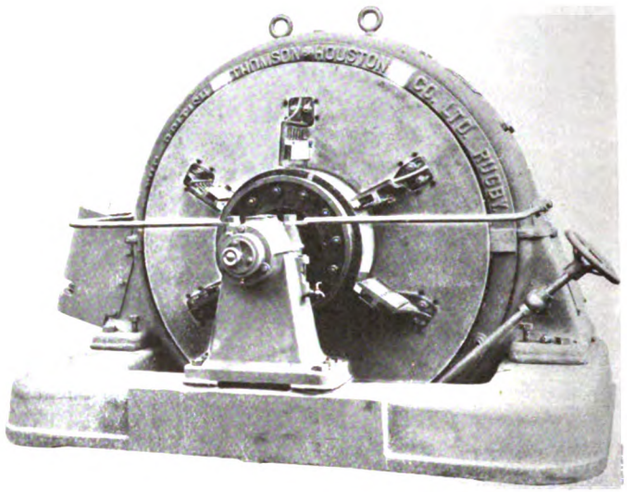

Fig. 19.—Rotary Converter.

ears in order to take care of the breaking of the arc. On service this device has been found to give exceedingly good results. The feeder circuit breakers are of the plain over-load type, and are designed to give a very heavy setting in order to take care of the momentary

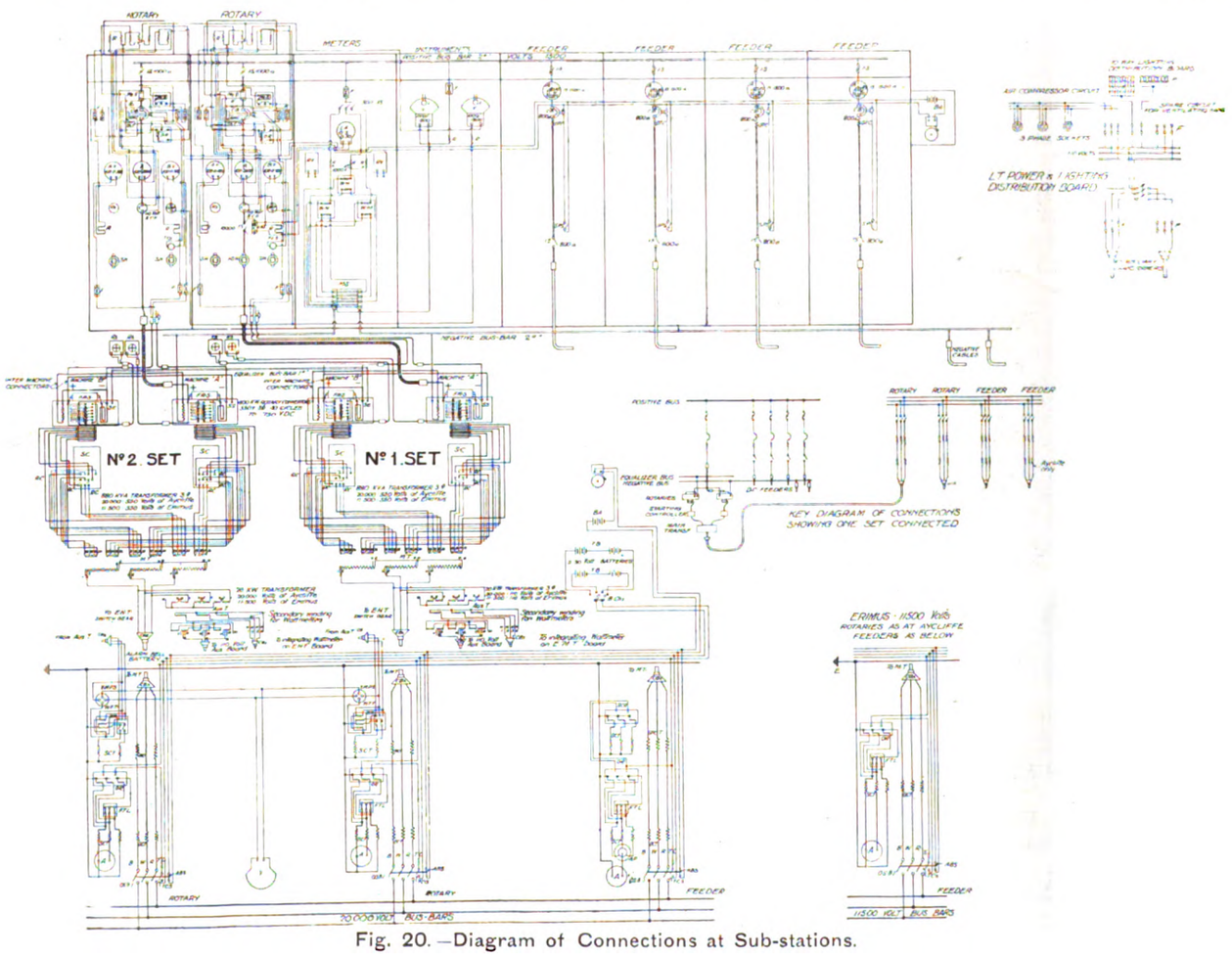

Fig. 20.—Diagram of Connections at Sub-stations.

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Fig. 21.—Interior of Aycliffe Sub-station.

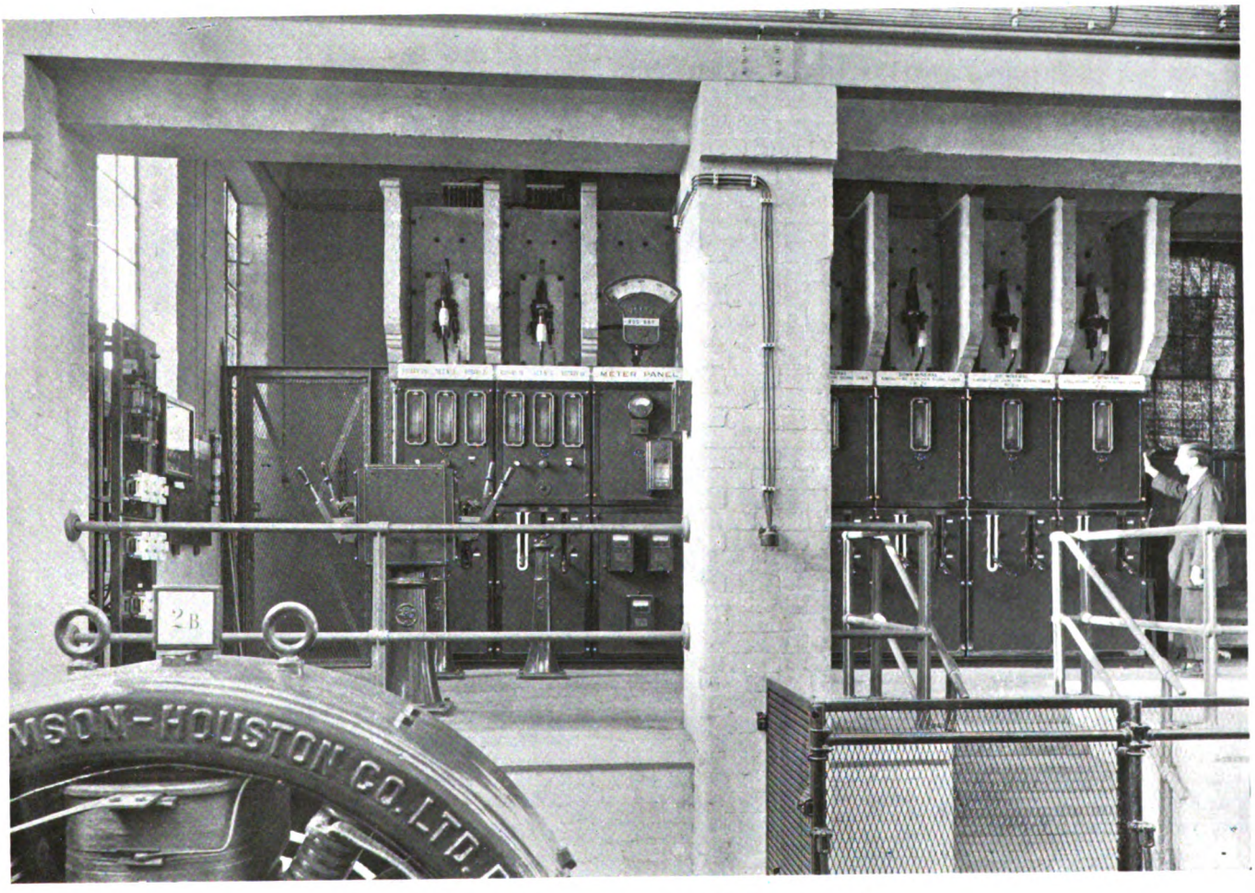

Fig. 22.—D.C. Switchboard at Aycliffe Sub-station.

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overloads experienced in a traction system of this description. The machine circuit breakers are of the overload and reverse current type. In conjunction with the reverse current a special single-pole relay of the differential type is provided, so that in the event of the rotary converter coming up of the wrong polarity it is impossible to close the circuit breaker on to the busbars. This relay is coupled up across the main contacts of the circuit breaker, and operates on to a shunt trip coil fixed to the circuit breaker release mechanism. This shunt trip coil is also arranged for operating from the over-speed device on the rotary converter sets.

For the metering of the power in the sub-stations, integrating wattmeters are fitted on the E.H.T. rotary equipments, and on the D.C. side 2-wire integrating watt-hour meters are fitted on the instrument panel. Three of these meters are furnished for check purposes and are operated from the same shunt, the shunt being fitted in the negative busbar between the machines and the feeders.

The control panels are of cast iron and form the front section of the bottom cubicles. On these panels are mounted the operating handles for controlling the circuit breakers and busbar isolating switches. Practically no exposed part projects beyond the surface of the panel, other than the operating handles. The instruments are of the vertical edgewise type, and are arranged for mounting behind the panel, a suitable slot with glass front being provided in the panel for these meters. The instruments themselves are carried on porcelain insulators fitted to the back of the panel casting.

The starting gear on the 800-KW. rotary sets is of the controller type, the machines being arranged for tap starting. These controllers are mounted at the end of the machine frames and direct on the main floor of the sub-station, the connections being taken straight down and carried on the basement floor. With regard to the larger set in Erimus sub-station, this rotary is of the self synchronising type, the starting gear consisting of two oil switches mounted in the transformer chamber and operated direct from the switchboard gallery. One switch is for the main rotary connections and the other for the starting motor. The operating mechanism for these oil switches is of the signal lever type, the operating shafts being carried on the underside of the basement floor.

In conjunction with this latter starting gear an operating handle is provided for controlling the series switch on the D.C. side of the rotary converter; this handle is mounted alongside the operating handles of the starting switches, and a system of interlocks is furnished for these three units, arranged so that: (1) before closing the starting motor switch the other two switches must be "off"; (2) before closing the main oil switch the starting switch must have been closed; (3) the closing of the series switch automatically opens the starting switch.

In conjunction with this starting gear an instrument panel is fixed alongside the operating handles. This panel contains an A.C. voltmeter to indicate that the rotary is in synchronism before closing the main starting switch. A D.C. voltmeter is also fitted to indicate the voltage of each rotary before closing the series switch.

Fig. 23.—Electric Locomotive Drawing Load.

In connection with the 800-KW. rotary sets, field splitting switches are provided of the remote controlled type arranged for operating direct from the switchboard gallery. These switches are mounted in the basement floor in the same structure as the main series switch supplied in connection with each rotary. This structure consists of marble panels completely covered in with expanded metal screenwork. The operating handles for controlling these switches are mounted on cast-iron pedestals fixed immediately in front of the D.C. control board.

The rheostats for the rotaries are mounted in the basement floor, and are controlled by operating handwheels fixed on the machine control panels, bevel gearing being provided for coupling up the control handwheel on the switchboard gallery to the rheostats in the basement.

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Each sub-station is connected to the overhead track wires by four positive feeders consisting of paper-insulated bitumen-sheathed single-wire armoured cables, each of ·5 sq. in. section, laid in wood troughing run in with bitumen. There are two negative cables at each sub-station connecting the track rails to the negative busbar, these cables being similar in size and type to those used on the positive side. A hand-operated travelling crane is fitted in each sub-station.

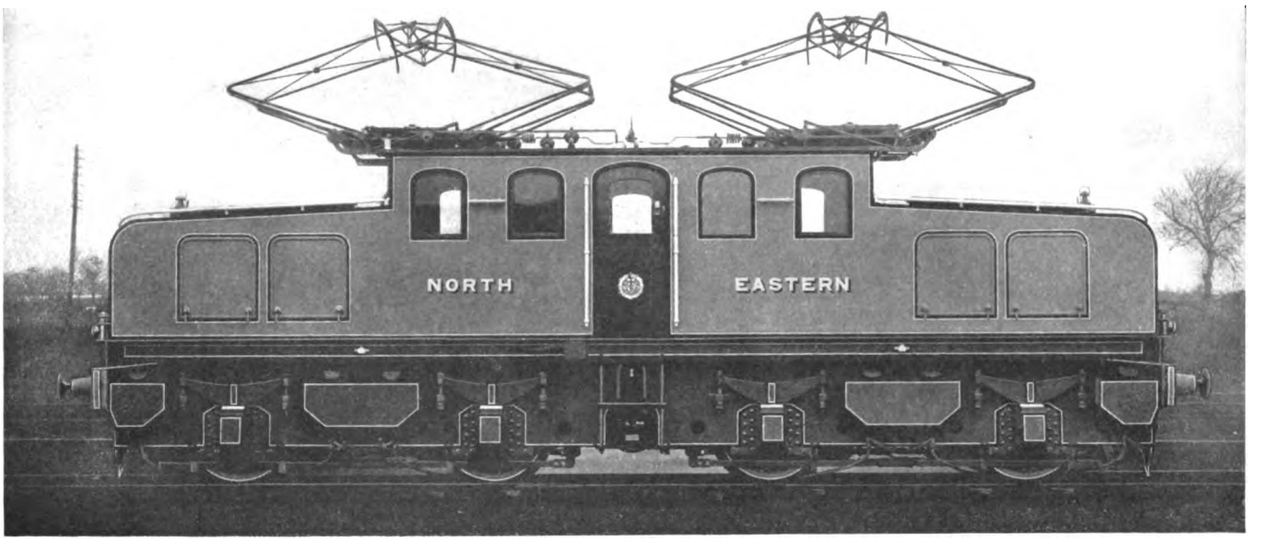

Fig. 24.—72-Ton Electric Locomotive with Four-Motor Equipment.

Locomotives.

The freight locomotives were designed and built at the N.E.R. locomotive works at Darlington, the electrical equipment being supplied and fitted by Messrs. Siemens Brothers, Dynamo Works, Limited, Stafford. They are designed to haul trains weighing 1,400 tons at a speed of not less than 25 miles per hour on the level. Fig. 23 shows a locomotive coupled to such a train. Other illustrations show various details and the general appearance of the engines, and below is a detailed description. The work was carried out under the direct supervision of the chief mechanical engineer, Mr. Vincent L. Raven.

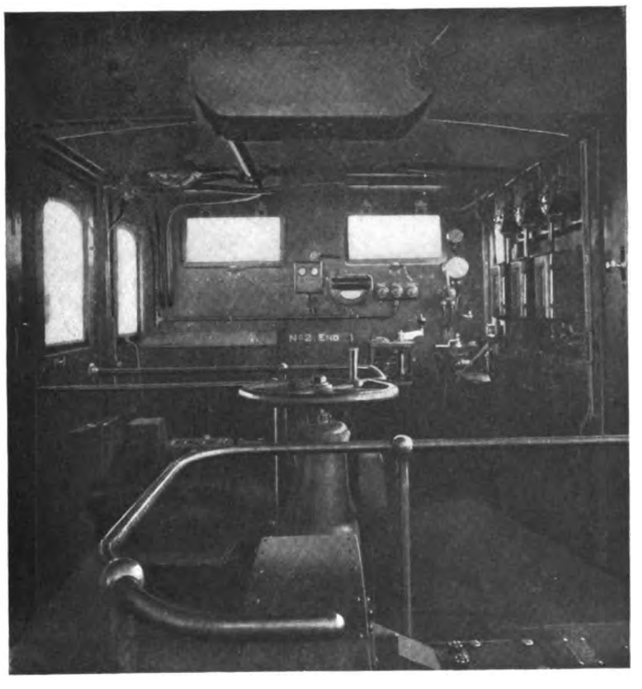

Fig. 25.—Interior of Locomotive Cab.

The engine may be described as an articulated truck locomotive in which the tractive effort is transmitted through the truck frames. The cab with sloping ends is supported on the centre of each truck by a strong steel casting, which embodies the centre pin bearing and side rubbing surfaces. These castings are securely bolted and rivetted to the plates of the cab platform, which consists of four beams secured to plates at the top and bottom. The transome between the truck frames at the centre is built up of plates and angles securely rivetted to the side frames of the truck. On the centre of the transome is a steel casting with which the centre bearing mentioned above engages. Rubbing pieces are fitted at each side, which bear on the rubbing surfaces mentioned above. The centre pin at No. 1 end is a good working fit in its bearings on the centre of the transome. At No. 2 end provision is made for creeping up of the trucks when passing round curves, but no allowance for movement transversely. The buffers are carried directly on the truck frames.

The trucks are connected by means of a buffer coupling, and arranged for lateral movement with vertical rigidity; the coupling is made with a slotted hole for a drawbar to pass through. The trucks are securely held together by means of this drawbar and a spring, which can be adjusted (the compression of the spring being $\frac{3}{8}$ in. per 7 tons load) to act as a connection between the two trucks. This spring cannot be subjected to heavy compression, resulting from buffing action, as the buffer part of the coupling between trucks receives the buffing stresses directly through the truck frames without subjecting the centre pins and platform to any stress other than those required to carry the weight of the cab apparatus on them.

The sloping ends are partitioned off from the cab, and contain the resistances, contactors, motor cut-out switches, multiple cut-out switches, and all high tension electrical apparatus. Entrance to each sloping end can be obtained through doors which are normally locked.

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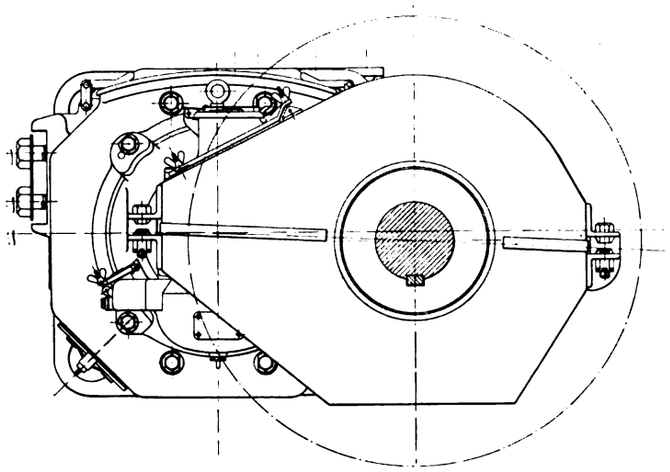
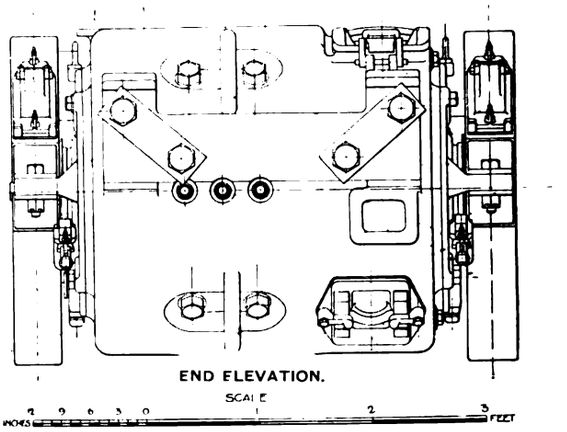
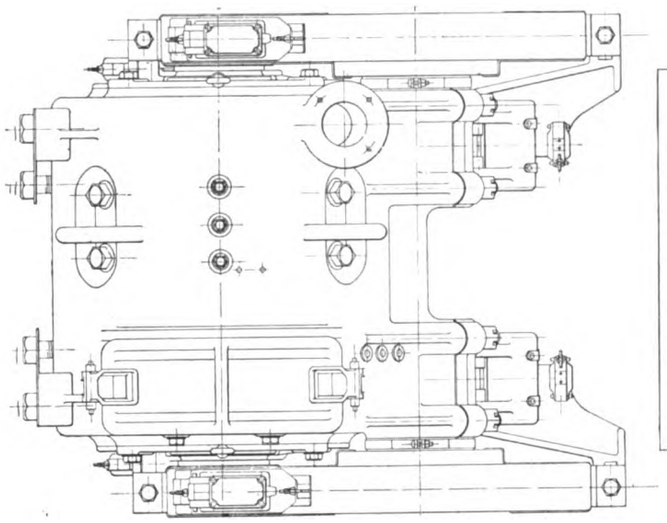


SIDE ELEVATION.



END ELEVATION.



PLAN.

Fig. 26.—Outline of the Motor.

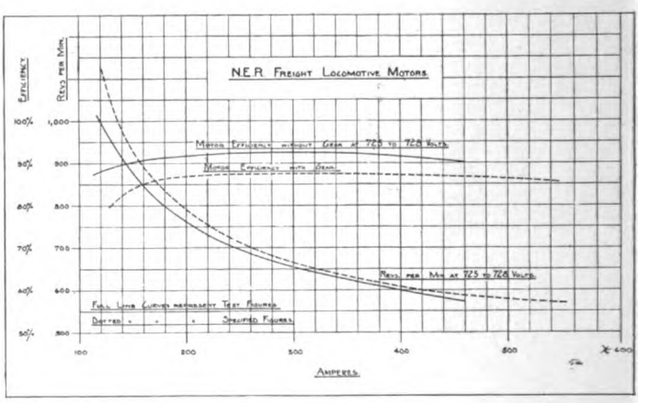
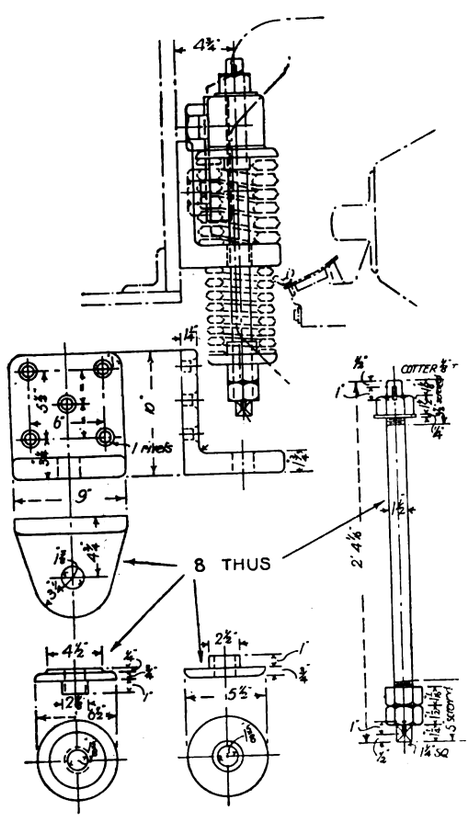


Fig. 28.—Performance Curves of Motors.



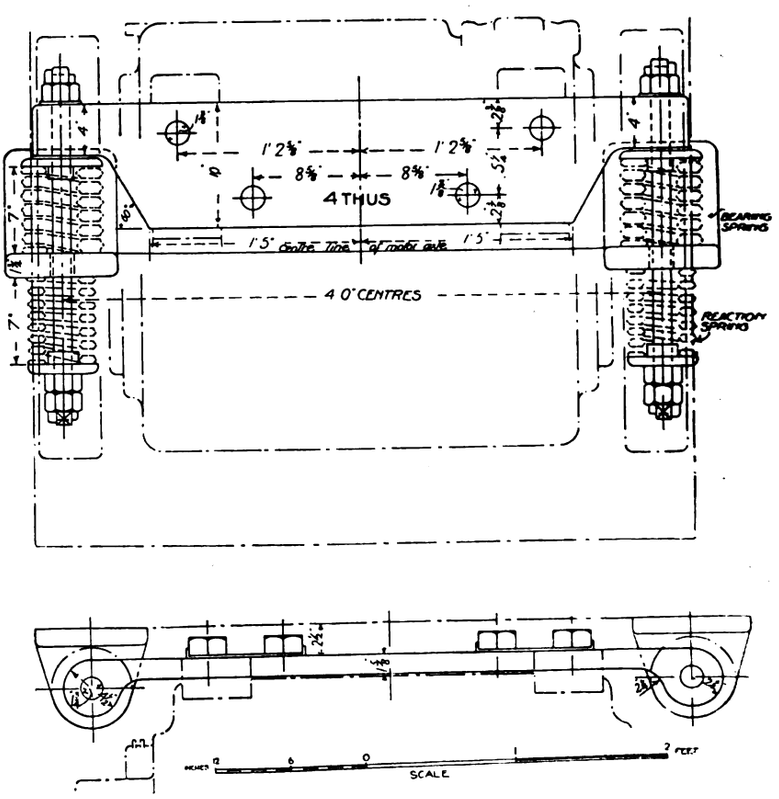


Fig. 27.—Details of Motor Suspension.

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The bow collectors on the roof of the cab are raised and maintained in connection with the contact wire by compressed air. A cock is fitted on the air system, the removable handle of which forms the key of the doors mentioned. This handle is so arranged that it can only be removed when the cock is in the exhaust position, so that it is impossible to open the doors of the sloping ends while the bows are in contact with the overhead wire.

In the cab, two master controllers are fitted, one at each end (Fig. 31). The cab also contains all auxiliary switches for controlling the air compressor and two dynamotors described later, and for lighting and heating. It further contains the control valves for the Westinghouse brake and for air sanding. In the centre of the cab there is a vertical hand wheel for the hand brake (Figs. 25 and 31). The dynamotors are securely fixed to the floor, the switches, &c., being placed on the sides of the cab and weather boards.

The principal dimensions and particulars of the locomotives are set out in tabular form below :—

	Tons.	Cwts.	Lbs.
Weight of electrical equipment, inclusive of motors	24	5	0
Do. of mechanical parts	50	3	0
Do. of motors without gear wheels and gear cases	3	3	0
Do. do. with gear cases and gear wheels	3	13	24
Total weight of mechanical and electrical apparatus	74	8	0
Approximate height of centre of gravity	4 ft. 6 in.		
Main dimensions of motors—Axial length over windings	24 13/16 in.		
Do. do. over core	11 1/8 in.		
Do. diameter of armature	21 5/8 in.		
Do. diameter of commutator	18 7/8 in.		
Do. length of commutator	7 3/8 in.		
Do. number of segments	195		
Do. air gap	1/4 in.		
Speed of motors at normal loco. speed of 25 miles per hour	787 revolutions per minute		

Dimensions of Mechanical Parts.

	Ft.	In.
Length over buffers	39	4
Height from rail to centre of buffers	3	5
Height of cab roof from rail	11	6 1/4
Height of trolley wearing strip from rail when down	13	1 15/16
Width of trolley wearing strip over horn ends	5	10 7/8
Width of cab	7	6 1/4
Width over footplate	8	4
Total wheel base	27	0
Wheel base of truck	8	9
Centres of trucks	18	3
Diameter of wheels	4	0
Diameter of wheel seat on axis	8 1/4 in. × 7 5/8 in. long	
Diameter of axle for spur wheel seat	8 5/16 in. × 5 1/2 in. long	
Diameter of journals	6 3/4 in. × 13 in.	
Motor suspension bearings on axle	7 7/8 in. × 13 13/16 in.	
Springs—laminated, 3 ft. 6 in. span, 18 plts., 4 in. × 1/2 in.		

Cab and sleeping ends constructed of steel channels, plates, and angles.
Under-structure 8 in. × 6 in. beams, 8 in. × 3½ in. channels, and ½ in. plates.
Trucks—articulated.
Truck frames—steel plates 1¼ in. thick.
Truck drag plates are flanged and rivetted up securely to frame plates.
Truck transome are built of plates and angles (steel) with cast-steel centre piece fitted on centre to receive centre pin on under-structure, also side bearers.

The motor equipment of each locomotive consists of four totally enclosed motors, each driving an axle through single reduction twin gearing. The gears are machine cut with straight teeth of the involute pattern, the face dimensions of the spur wheels and pinion being 3 1/16 in. A pinion is mounted on each end of the armature shaft, and meshes into a corresponding gear wheel mounted on the running wheel axle, the gear ratio being 1 to 4·5. Fig. 26 shows an outline of the motor with the gearing and gear case. The motors are suspended by means of a crossbeam suspension bar, with bearings and reaction springs (Fig. 27). These, with the motor suspension bearings on the axle, provide the motors with four points of suspension.

The four main motors are fitted two in each bogie, and are each wound for 750 volts, the pair of motors in each bogie being connected permanently in series. The four main motors of each locomotive thus form two units, which are controlled on the usual series-parallel system.

Each motor is capable of developing 275 brake horse-power at a speed of 20 miles for one hour with forced ventilation. The motor equipment is capable without injury of exerting a torque sufficient to skid the wheels under any conditions of rail, and will exert an average pull of 28,000 lb. at the tread of the wheels when starting under normal conditions of rail. The maximum pull at the tread of the wheels is, of course, considerably greater than this.

The motors and gearing are designed to run at a speed of 45 miles per hour without exceeding the limits of safety, but the normal speed on the level when hauling a train of 1,400 tons is 25 miles per hour. The equipment is so designed that each locomotive is capable of performing four round trips in twelve hours, each consisting of a trip from Shildon to Newport with a train of 1,400 tons, followed by a trip from Newport to Shildon with a train of 800 tons, the distance of each trip being about 18 miles. The locomotives are able to start a train of 800 tons from rest on a grade of 1 in 100, and accelerate to normal running speed.

A novel feature is the ring lubrication on the motor shaft. The gearing is enclosed in a welded sheet-iron case fitted with a syphon wick oil lubricator. Sight doors are fitted on the gear case, so that the condition of the gears can be regularly examined. The air for ventilating the motors is supplied from fans driven by the dynamotors, which are described later. In order to avoid the use of a flexible pipe between the fan air duct in the base of the cab structure and the motors, a special form of spring sliding gland is employed. The fans furnish air to the motors at low pressure through pipes to a box fitted between the top and bottom plates of the platform, the gland above mentioned being fitted on this box. The air inlets to the fans are at the end of the platform, a trough being formed in the cab under structure to convey the air from these inlets. Provision is also made to draw air to the fans from the cab if necessary. The normal quantity of air passed through each motor case is 700 cubic feet per minute.

Fig. 28 gives the performance curves of these motors as ascertained from shop tests.

The general arrangement of the control wiring is shown in Fig. 29. Two master controllers are fitted in the cab, one at each end. Notching up can either be carried out by hand or automatically. The automatic arrangement consists of a spring which is wound up by the controller handle, the speed at which the controller drum follows the handle being governed by a step by step escapement movement.

The maximum current taken at each step is limited by a limit switch fitted in the sloping ends of the cab, which on the current rising beyond a predetermined limit, closes the circuit of a small magnetic interlock, which locks the escapement mentioned, holding the drum of the controller until the current has fallen to the required value. In addition to the above, by means of a catch inside the controller, which, when lifted,

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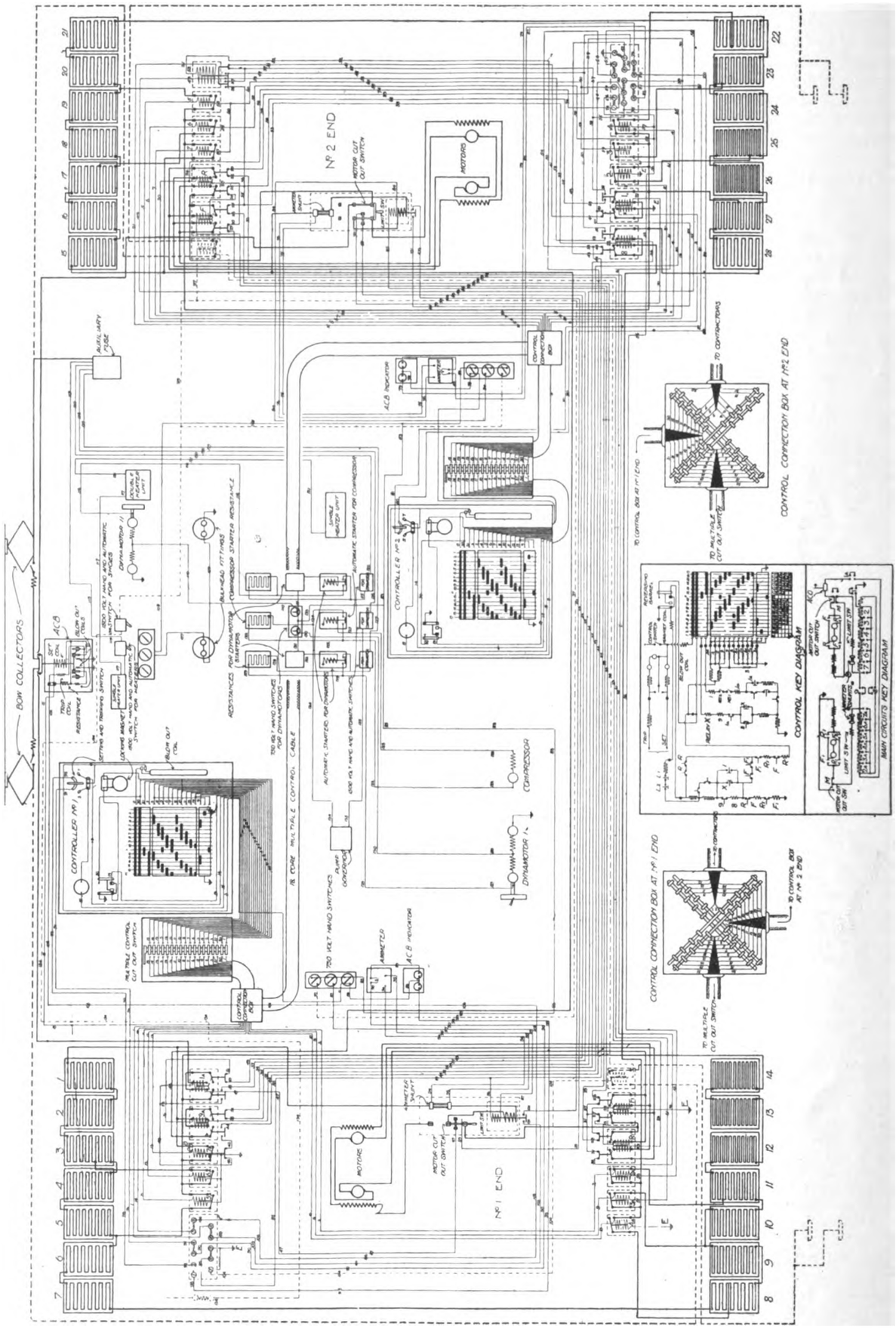

Fig. 29. Diagram of Locomotive Connections.

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disconnects the spring and escapement action, the automatic arrangement described can be thrown out of action and notching performed by hand.

An acceleration switch is also provided, so that in special circumstances the adjustment of the limit switch mentioned can be altered by short-circuiting the turns of an opposing coil, thus allowing of a larger current for accelerating under special conditions.

Each master controller is fitted with the usual reversing barrel, the handle of which can only be removed when in the "off" position. When left in this position, the reversing handle locks the main handle. There is also fitted on the master controller a small spring switch, by means of which the automatic circuit breaker on the locomotive can be tripped or set. This switch is also locked by the reversing

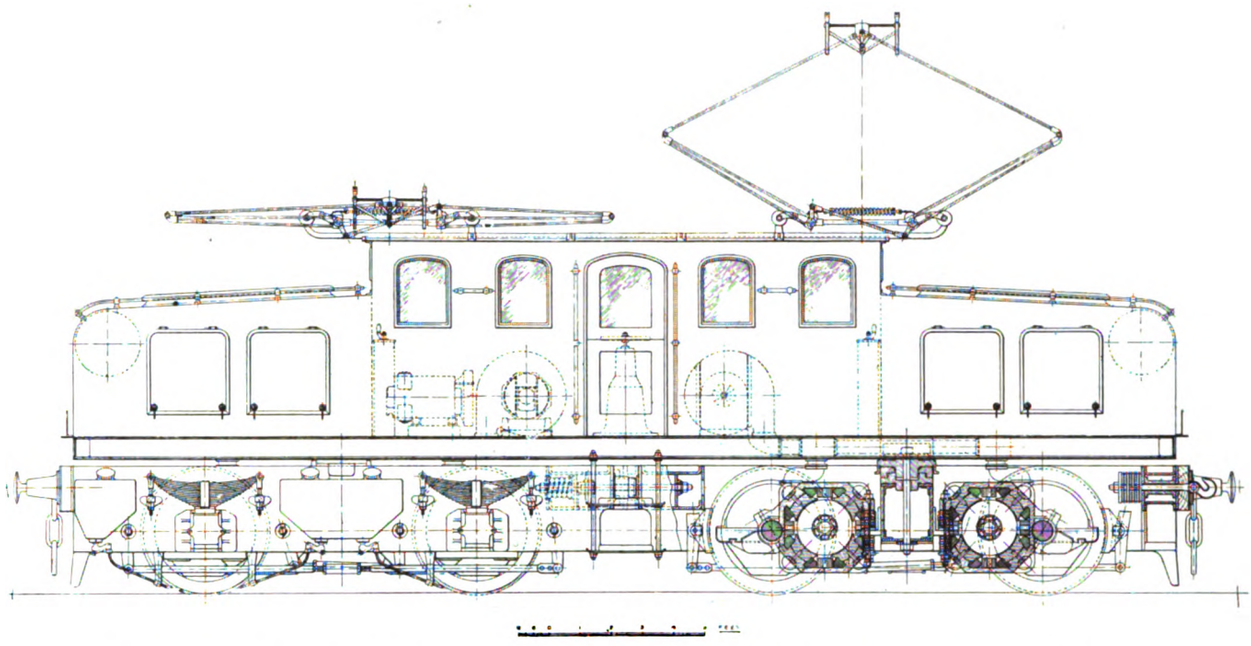
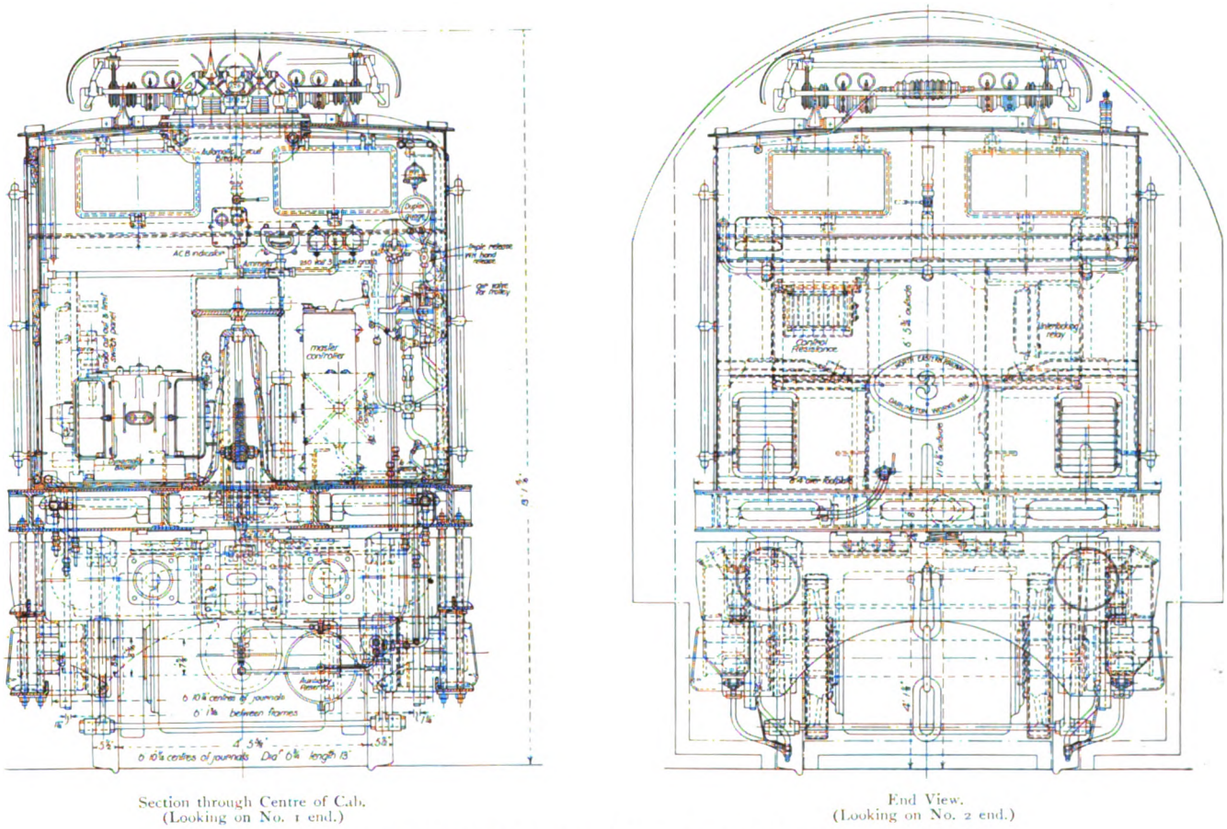


Fig. 30.—Side Elevation of Electric Locomotive, showing One Bow Expanded and the Other Collapsed.



Section through Centre of Cab.
(Looking on No. 1 end.)

End View.
(Looking on No. 2 end.)

Fig. 31.—Arrangement of Electric Freight Locomotive (Cross Section and End View).

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handle in the "off" position. Current for operating the whole of the control circuits and the lighting and heating in the cab is supplied from either of the dynamotors at a pressure equal to half the line voltage.

The contactors are electrically operated, and are also fitted with auxiliary interlocking contacts to ensure their operating in the correct order. The resistances, which are of the usual cast-iron grid type, are fitted in the sloping ends, but are partitioned off from the other apparatus in these compartments.

As can be seen from Fig. 35, louvred openings are fitted at each end of the locomotive, providing natural ventilation for the resistances through rain-proof air vents on the top of the sloping ends.

The main automatic circuit breaker is fitted on the roof of the cab, and controls the current to the traction motors. This circuit breaker is fitted with horned spark gaps, which project through the roof of the cab, as can be seen in Figs. 20 and 32. The circuit breaker is operated either by means of the set-and-trip switch on the master controllers as mentioned, or by means of a mechanical hand trip fitted on the circuit breaker case. The circuit breaker, however, can only be closed by the set-and-trip switch on the master controller. Red and green lamps are provided to indicate whether the circuit breaker is set or tripped. An illuminated dial ammeter is provided at each end of the cab in front of the driver.

As mentioned above, two independent dynamotors are fitted in the cab of each locomotive. The armatures of these machines are double wound, and fitted with two commutators, the commutators being connected in series across the full line voltage. The control circuit is tapped off between the centre point and earth, so that current is obtained for these circuits at approximately half line voltage. The actual voltage when supplying the control circuits and about one kilowatt for lighting is about 710 volts. The speed is 1,500 revolutions per minute.

The shaft of each dynamotor is extended and fitted with a fan, each fan supplying ventilating air to the pair of main motors on one bogie. The rated continuous output with a 50 deg. C. temperature rise is 4·5 kilowatts. Each dynamotor is controlled by an ironclad circuit breaker and a no-arc fuse. A starting resistance is in circuit with each machine, this resistance being automatically short circuited by a relay a few seconds after the circuit breaker is closed.

A motor-driven air compressor is fitted in the cab of each locomotive for supplying air for the Westinghouse brake equipment, air sanding, raising the bow collectors, and for air whistles. The machine is capable of dealing with 50 cubic feet of free air per minute, and of raising this to 100 lb. per sq. in. pressure.

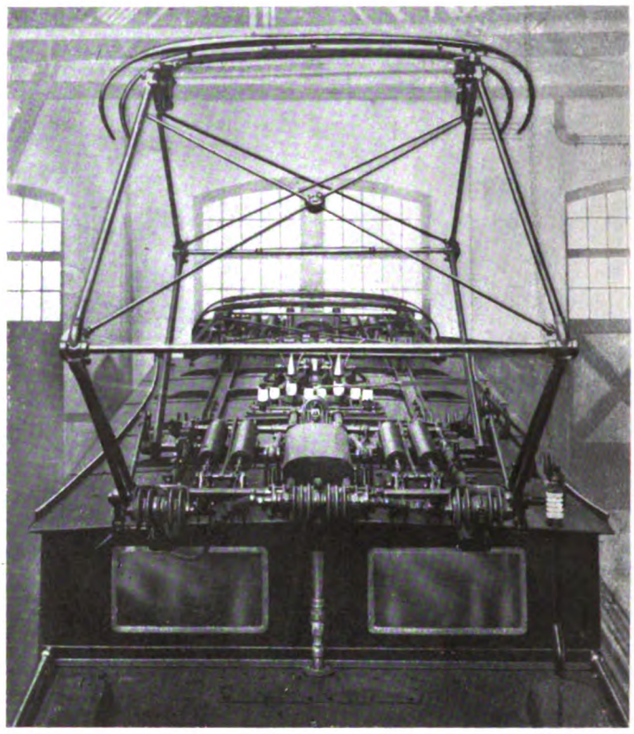

Fig. 32.—End View of Locomotive Bows.

The motor and compressor is run at line voltage, and is coupled direct in the circuit of the collector bows on the line side of the main circuit breaker, so that immediately on the bows being raised by the hand pump, as described later, the compressor starts to pump the air in the reservoir up to full working pressure. It is controlled by a circuit breaker similar to those

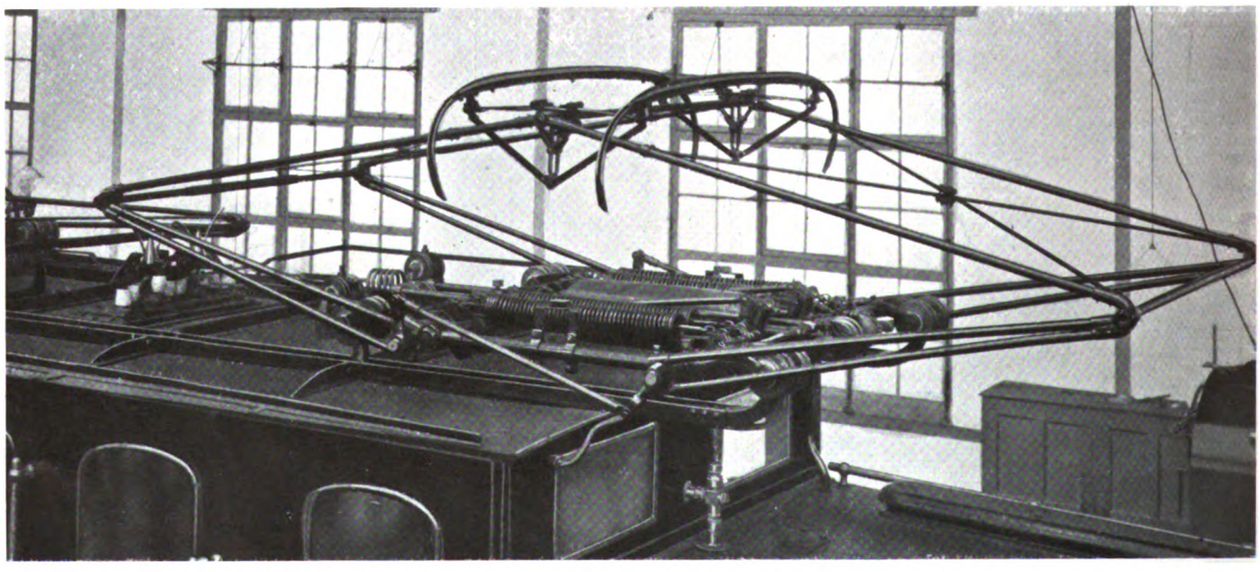

Fig. 33.—Side View of Locomotive Bows.

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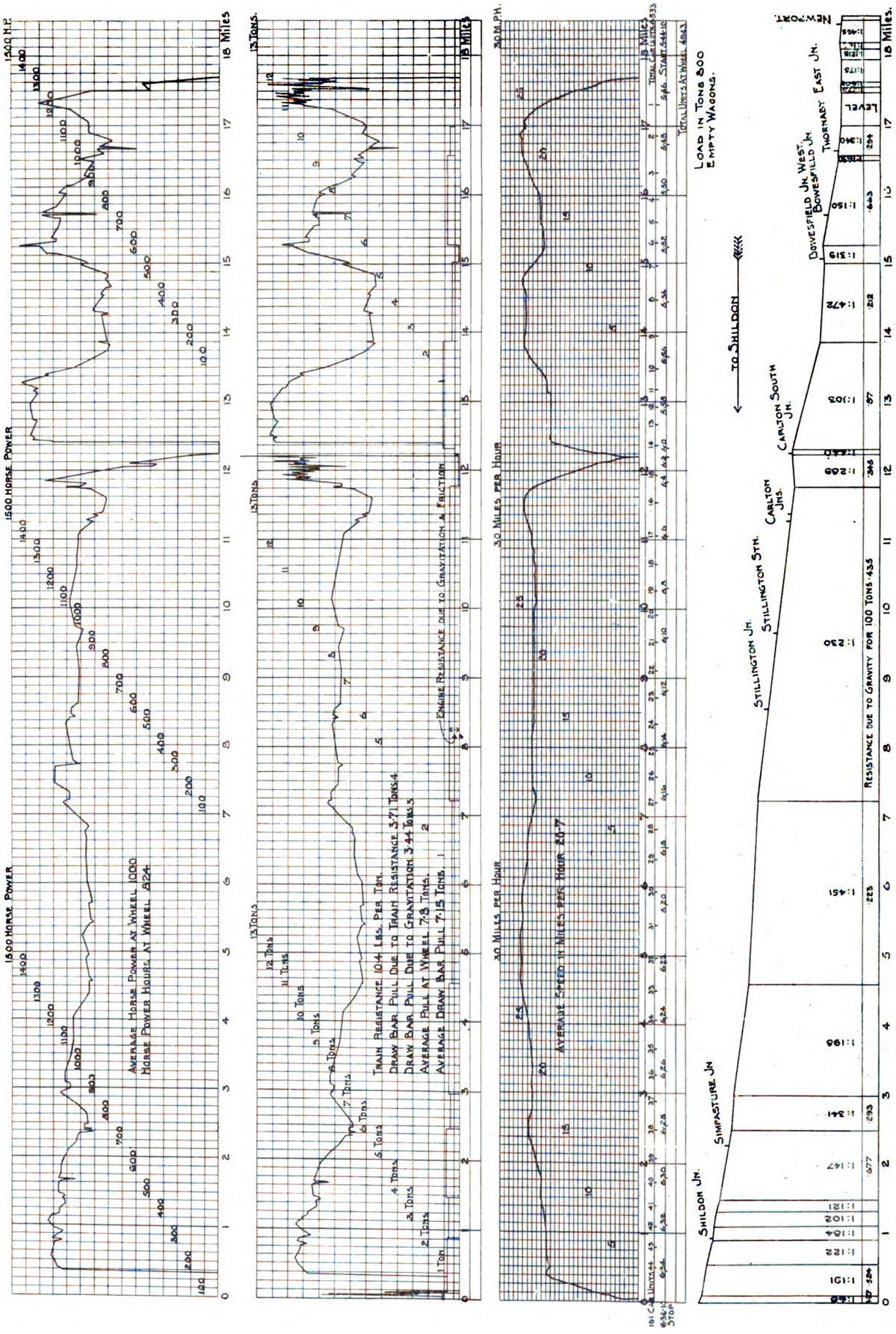

Fig. 34.—Performance Curves and Diagram of Gradients.

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controlling the dynamotor circuits, a starting resistance being provided and short circuited by an automatic relay in the same manner, but in this case the relay is fitted with a time limit arrangement to extend the starting time. An automatic governor is provided for the compressor, and is so arranged that the motor circuit is opened when the air pressure rises to 100 lb. per sq. in., and closes again when the pressure falls to 80 lb. per sq. in.

Two bow collectors are provided on each locomotive. These can be seen in position on the roof of the cab in Figs. 32, 33, and 35. Each collector consists of a hinged pantograph built up of steel tubing, the whole being supported off the cab structure by strong corrugated insulators. Fig. 33 shows a side view of one of the collectors in position, and Fig. 32 shows a general view of the top of the cab, showing both bow collectors in position, one being collapsed, the other raised to the full extent. Each collector has two bows, each fitted

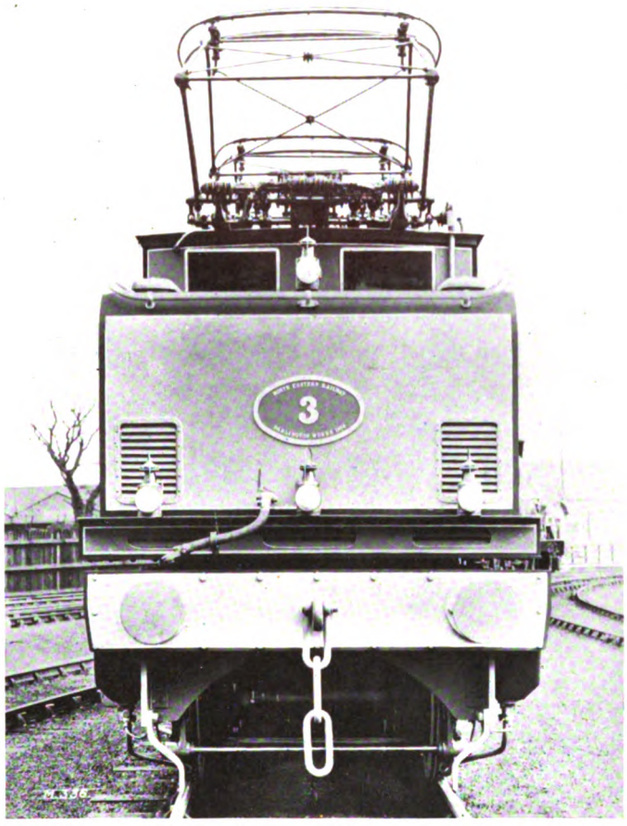

Fig. 35.—End View of Locomotive.

with an aluminium rubbing strip making contact with the overhead contact wire. There are thus four rubbing strips per locomotive, which, with the double contact wire, makes eight points of contact. Each of the two collector bows on a pantograph is attached to it by two separate leaf springs, so that they provide for any small irregularities in the level of the contact wire independently of the vertical movement of the pantograph itself.

A hand pump is provided by means of which the bows are raised at the commencement of the day's working if no pressure is available in the reservoir. By means of the control cocks in the cab, either one or both of the bows can be raised or lowered. Each pantograph is raised and maintained in contact with the overhead wire by means of an air cylinder, so that in the event of a failure of the air pressure, the bows are automatically lowered. The air cylinders raise the pantographs through springs which can be seen in the views, and which maintain an even pressure against the contact wire notwithstanding variations in its height.

An existing engine shed at Shildon was adapted for the use of these locomotives, a sufficient portion being electrically equipped for the purpose. An automatic circuit breaker is provided controlling the whole of the shed equipment, and each engine stall is controlled by an independent isolating and earthing switch, so that work can be safely carried out on the roof of any locomotive without interfering with the operation of locomotives in adjacent stalls.

Electric Locomotive Tests.

Tests have been carried out recently with one of the electric locomotives. Several journeys were made between Shildon and Newport, a train of 1,400 tons of laden wagons being taken from Shildon to Newport and a train of 800 tons, consisting of 92 empty wagons, hauled from Newport up to Shildon with stops on certain of the heaviest grades. The 800-ton train was stopped and started on a grade of 1 in 103. The maximum draw-bar pull during the tests reached 16 tons, the average speed on the run up from Newport to Shildon being 18·3 miles per hour, the maximum speed being 26 miles per hour. Up a grade of 1 in 230, which is 4½ miles long, the 800-tons load of empty wagons was hauled at an average speed of 23 miles per hour. The locomotive also proved capable of hauling the 1,400-tons train on the level at 26 miles per hour. The general operation of the locomotive proved satisfactory in all respects throughout the test.

Principal Firms Engaged in the Work.

The following were the principal firms responsible for carrying out the work :—

Locomotives.—North Eastern Railway Company. Darlington.

Overhead track equipment and electrical equipment of locomotives.—Siemens Brothers' Dynamo Works, Limited, Stafford.

Steelwork and brickwork for the sub-station buildings.—R. Blackett and Son, building contractors, Darlington.

High tension switchgear in sub-stations.—Contractors, the British Thomson-Houston Company, Limited, Rugby ; sub-contractors, A. Reyrolle and Company, Limited, Hebburn-on-Tyne.

Rotary and static transformers for the sub-stations.—Contractors, the British Thomson-Houston Company, Limited, Rugby ; sub-contractors, the British Westinghouse Electric and Manufacturing Company, Limited, Manchester.

Cranes in sub-stations.—Herbert Morris, Limited, Loughborough.

20,000 and 11,000 volt overhead transmission lines and cables supplying the sub-stations.—The British Insulated and Helsby Cables, Limited, Prescot.

Mr. Arthur Pollard, architect for the North Eastern Railway Company, York, arranged the order for the sub-station buildings.

We wish to add an expression of our indebtedness to the consulting engineers, Messrs. Merz and McLellan, by whose courtesy we are enabled to publish the foregoing account and illustrations of an undertaking which is not only of great interest in itself, but which, as a pioneer of electric goods service in the United Kingdom, promises important developments in the future.

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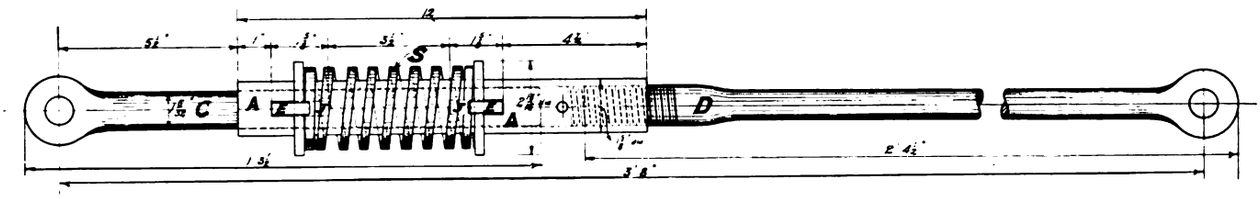
HOLT'S SIMPLIFIED CONNECTING ROD FOR TRAMWAY POINTS.

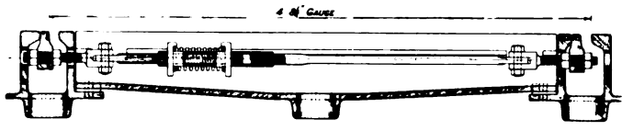
This improved connecting rod for tramway points acts as a shock absorber and adjuster. The rod has been designed to overcome the difficulty experienced in the straining and buckling of point connecting rods, and also to dispense with the right and left hand turnbuckles usually attached to these rods. Owing either to carelessness on the part of the man opening the points, or to the accumulation of mud in the tongue recess, it frequently happens that the point tongues are not opened or thrown over to the full extent, with the result that when the car wheels enter the points, the tongues are violently forced over, and either buckling or elongation of the connecting rod occurs.



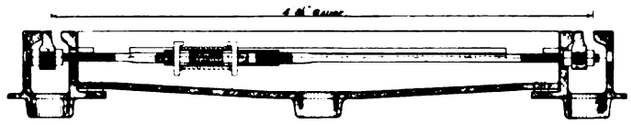
Plan of Complete Absorber.

The device designed by Mr. R. B. Holt renders either buckling or elongation of the connecting rod quite impossible.

The improved connecting rod dispenses with the usual right and left hand turnbuckle ; the two lengths of bar forming the connecting rod being coupled in the following manner :—A short steel tube A is passed over the ends of the bars C and D. The end of the bar D is screwed into the tube A, and the bar C is free to move inside the tube (within the limits of the slot hole). Stout keys E are passed through slot holes J in both the tube and the bar C, and these with suitable washers hold in position the spring S.



A.—Connections with Link Ends Bolted through Tongue.



B. Connections Bolted through Tongue.

C.—Connections with Tongue Working in Renewable Slides.

D.—Showing Connect ons to Work Automatically, Applied to either A, B or C Types.

The spring is of usual dimensions for this class of work, and will accommodate itself to the following stresses :—(1) Compression from either right or left, (2) extension from either right or left, (3) compression from both right and left simultaneously, (4) extension from both right and left simultaneously. Application has been made for a patent for the device.

INTERCONNECTION OF POWER STATIONS.

The Railway Department of the Board of Trade have sent the following communication to electric supply undertakings : -

The Central Coal and Coke Supplies Committee have had under consideration the increasing difficulty in providing for the supply of coal to important consumers, and have advised the Board of Trade that in view of the possibility of a serious shortage in the near future every practicable economy in consumption should be adopted without delay. In this connection the Board desire to call attention to the very considerable saving that can be effected by the adoption of arrangements for interconnection and joint working of electric supply undertakings, including interconnection with stations supplying tramways and railways. The Board are aware of the difficulties involved at the present time, particularly in regard to labour and materials, but they are advised that in many cases the necessary arrangements could be made at once, and they wish therefore to urge upon electric supply undertakers the necessity in the national interest of taking immediate steps to avail themselves to the fullest possible extent of the powers which exist for the purpose. Any application which may be made to the Board of Trade for their approval of such arrangements under the powers conferred on them by the Electric Lighting Act, 1909 (Section 4, Sub-section 3), and the London Electric Supply Acts, 1908 and 1910, will receive their immediate attention. The Board are prepared to assist as far as possible in cases where difficulty is experienced in securing the agreement of all the parties interested in any proposed scheme or in arranging the terms and conditions under which it shall be carried out.

Before the issue of the letter a scheme on similar lines for Lancashire and Cheshire had already been taken up by the Municipal Electrical Association of those counties, as the result of a suggestion made by Mr. J. A. Robertson, the electrical engineer to Salford Corporation, and a committee are now collecting data. The chairman is Mr. S. L. Pearce (Manchester), and the other members are Messrs. B. Welbourn (Prescot Electric Light Company), J. A. Robertson (Salford), hon. secretary, C. C. Aitchison (Rochdale), S. E. Britton (Chester), H. Dickinson (Liverpool), E. H. Edwards (South Lancashire Tramways Company), R. Blackmore (Stalybridge), J. Purrett (Lancashire Electric Power Company), S. J. Watson (Bury), P. P. Wheelwright (Blackburn), and J. A. F. Aspinall (general manager, Lancashire and Yorkshire Railway).

WHERE TRAMWAY FARES HAVE RISEN.

Reporting to Bradford Tramways Committee on a proposal to lengthen penny stages, Mr. C. J. Spencer, the general manager, says :—" The proposal to cheapen fares at the present moment is, in my opinion, very inadvisable, though I agree that under normal circumstances the proposition is in the right direction. I have made inquiries from seventy-eight towns as to alterations in fare stages since the beginning of the war, and I find that in twelve towns, including Birmingham, fares have been increased since the war started. In sixty-six towns no alteration has been made, and only in one case has any decrease in fares taken place. It would be difficult to find a commodity of any description which has not increased in price, let alone decreased, since the outbreak of war. The cost of operation of tramways has increased considerably, and gives every indication of still further increase in the future." Mr. Spencer also stated that " the total cost of operation per car-mile, including interest and sinking fund, for the year just closed amounted to 11·905d. Taking the last five years of peace, ended March 31, 1914, the receipts per car-mile averaged 11·439d., which was ·466d. per car-mile less than the expenses for the year just closed. If the receipts of war time had been the same per car-mile as the average of the previous five years in peace time there would have been a loss of nearly ½d. per car-mile on every mile run during the year, so that if the receipts per car-mile in the war period had not been in excess of the receipts in peace the undertaking would have shown a loss of £12,900. The extension of the penny fare stages under present conditions would result in a considerable loss of revenue, unless it were possible to put on additional cars to meet the extra traffic attracted. Under present conditions it would be impossible to provide cars, so that two things would inevitably happen, viz., (1) a reduction in receipts, and (2) a still further overcrowding of cars." The committee adopted the report.

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PARIS MUNICIPAL TRAMWAYS.

(Continued.)

The first instalment of the description of the work of converting the Paris tramways to electric traction, which appeared in our issue of May 11, concluded with details of the types of conduit construction which were adopted in districts where overhead wires were deemed inadvisable. We now give some facts and a number of interesting illustrations of the special conduit work constructed in Allen's "Imperial" manganese steel. Up to the outbreak of the war Messrs. Edgar Allen and Company, Sheffield, had supplied nearly 200 tons of these lay-outs for the Paris tramways.

A complex example is shown in Fig. 1. It is a double junction curved to the left, type No. 4, supplied for the line Puteaux (Marché) Madeline-Carrefour Haussmann Faubourg Saint Honoré. This junction comprises, independent of track and slot points, 14 conduit crossings, 6 track crossings, 2 cast-steel frames which are fitted and bolted to crossings opposite the intersection of the slot crossings, and afterwards fitted up

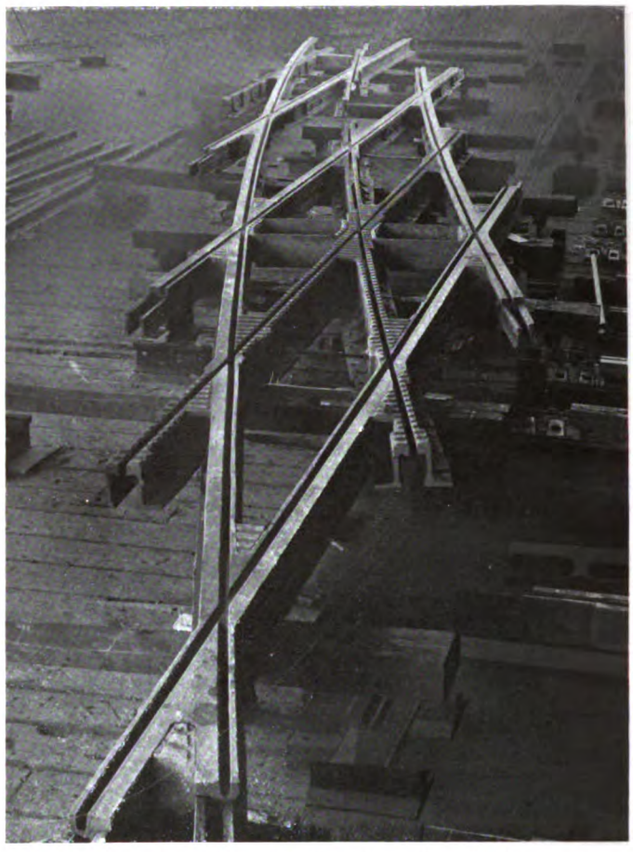

Fig. 1.—A Double Junction Curved to the Left.

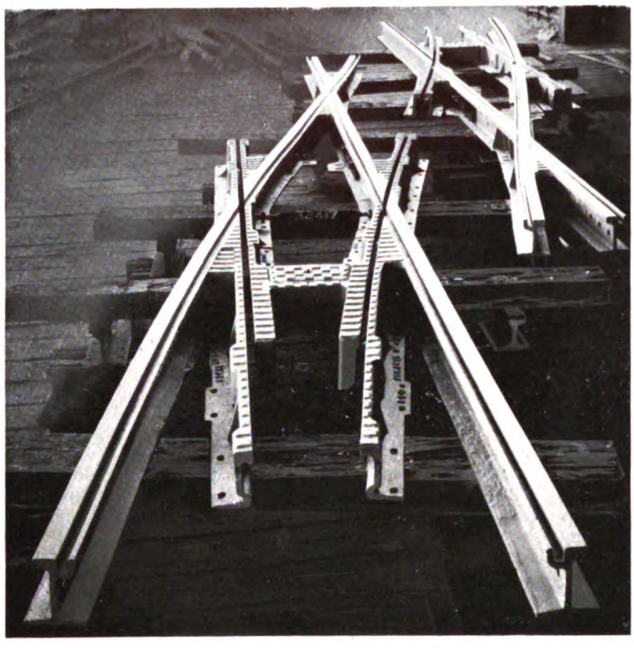

Fig. 2.—A Right Hand Cross-over of 30 Metres.

with paving blocks. There are also 2 cast-steel frames with lids, which are bolted on to four different castings, viz., the support for the slot point, the slot point, and the two interior or exterior groups of conduit castings. The radii of the outer curve for this layout are 120 metres at the broad end, running into 30 metres radius points, and the distance from the toe of the points to the intersection of the further crossing is 22·457 metres. The total weight of these crossings is 8½ tons. The longest crossing is 4·5 metres, and is V-shaped. This view is typical of numerous layouts curved both to right and left.

Fig. 2 represents a right-hand crossover, 30 metres radius, with a total weight of 3¼ tons. A right-hand crossover of 50 metres radius is shown in Fig. 3. The length of the track points is 3·940 metres, with a tongue 2·913 metres long. The total weight of this job, consisting of two track crossings, 8 slot crossings, and 2 pairs of points, is 6 tons. Fig. 4 is a crossover (90 deg. double track over double track) for Line 14 and E.P. Place de la Bastille. The weight is 84 cwt. A similar crossover (37° 14′) for Line No. 6, crossing

Fig. 3.—A Right Hand Cross-over of 50 Metres Radius.

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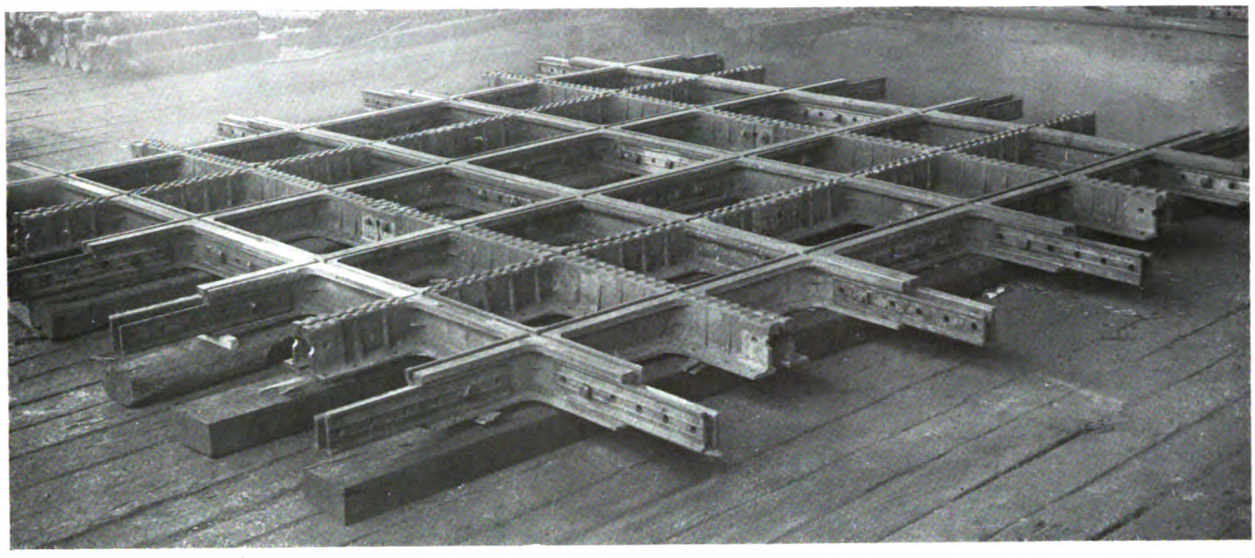

Fig. 4.—Double Track over Double Track Cross-over.

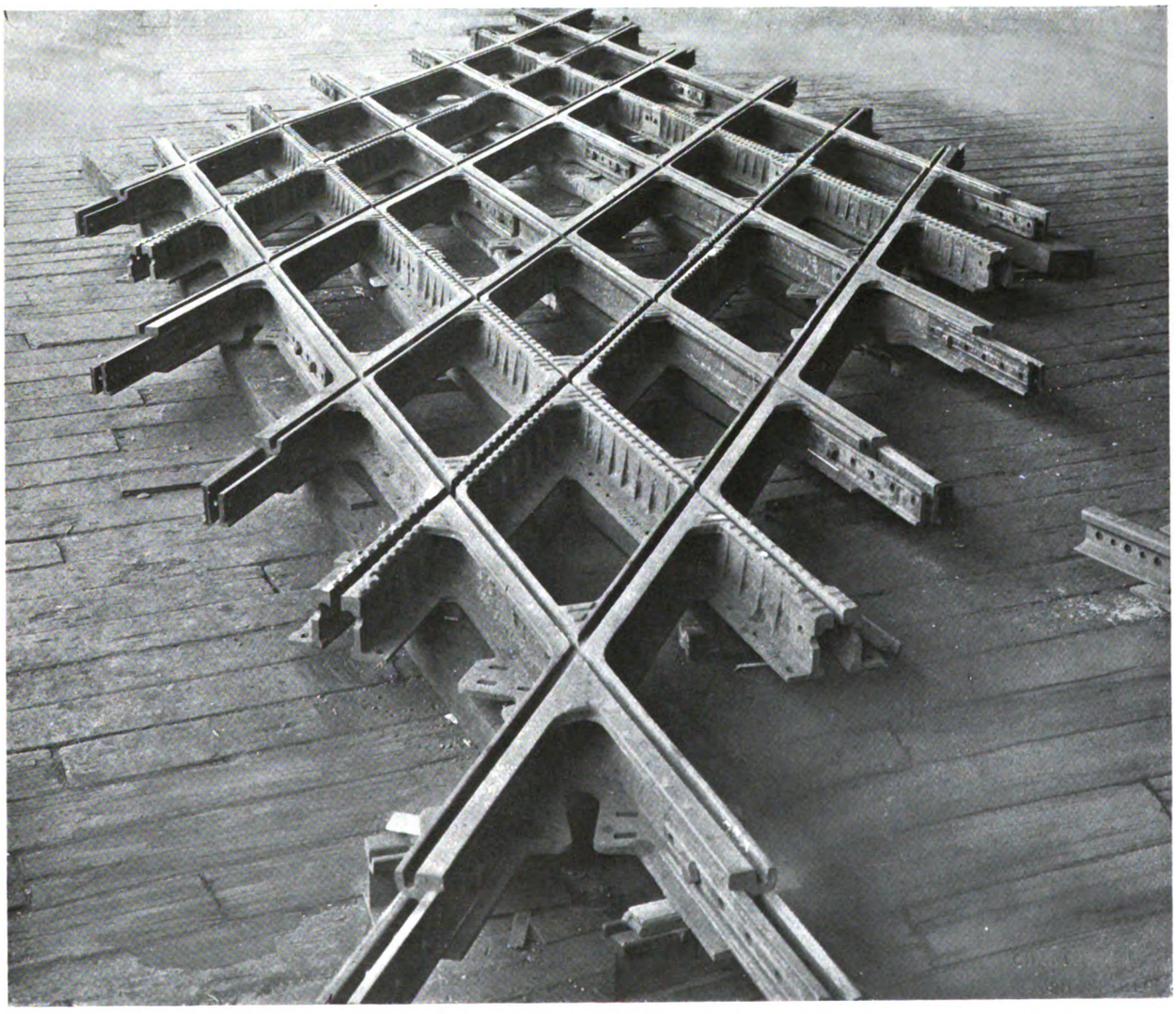

Fig. 5. Double Track over Double Track Cross-over.

SPECIAL CONDUIT TRACKWORK—PARIS MUNICIPAL TRAMWAYS.

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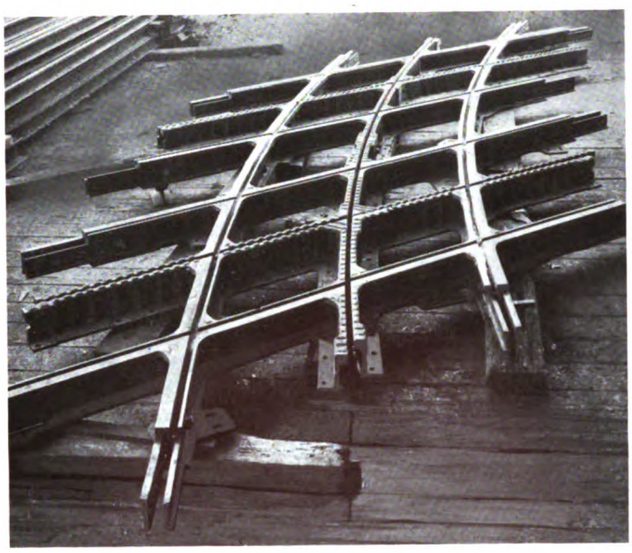

Fig. 6.—Curved Cross-over over Two Tracks.

Reaumur Turbigo, is shown in Fig. 5. The weight is 7¼ tons. The work shown in Fig. 6 was supplied for Line No. 1, Cours de la Reine (Terminus de l'Alma). The weight is 3¼ tons. The three latter castings are curved to a radius of 20 metres.

Numerous crossovers, varying in angle from 37° 14′ to 90 deg., are represented by these views and by the drawing (Fig. 7), which gives a clear idea of the fitting up, and shows the centres of the yokes, which are fixed diagonally, with two additional supports at each slot intersection. About 24 yokes and eight centre supports are required for this type of crossover. If the crossovers are over the angle of 50° 45′, the method of supporting the castings is different, a yoke No. 6 being fixed under each track rail. Thus, for every star or group of four crossings, four No. 6 yokes are required, together with a centre support. This method of support is also applicable for curved crossovers (Fig. 8). The most difficult type of casting to make for these lay-outs is the V-shaped slot crossing (Fig. 1), owing to the difficulty in contraction on account of the preponderance of metal at one end and the thin nose at the other. All castings have to be ground to depth and section. The pockets for the tiebars have also to be carefully ground, so that the nuts shall not foul the plough. The slot fishplates must make a good joint with the adjoining rail or casting.

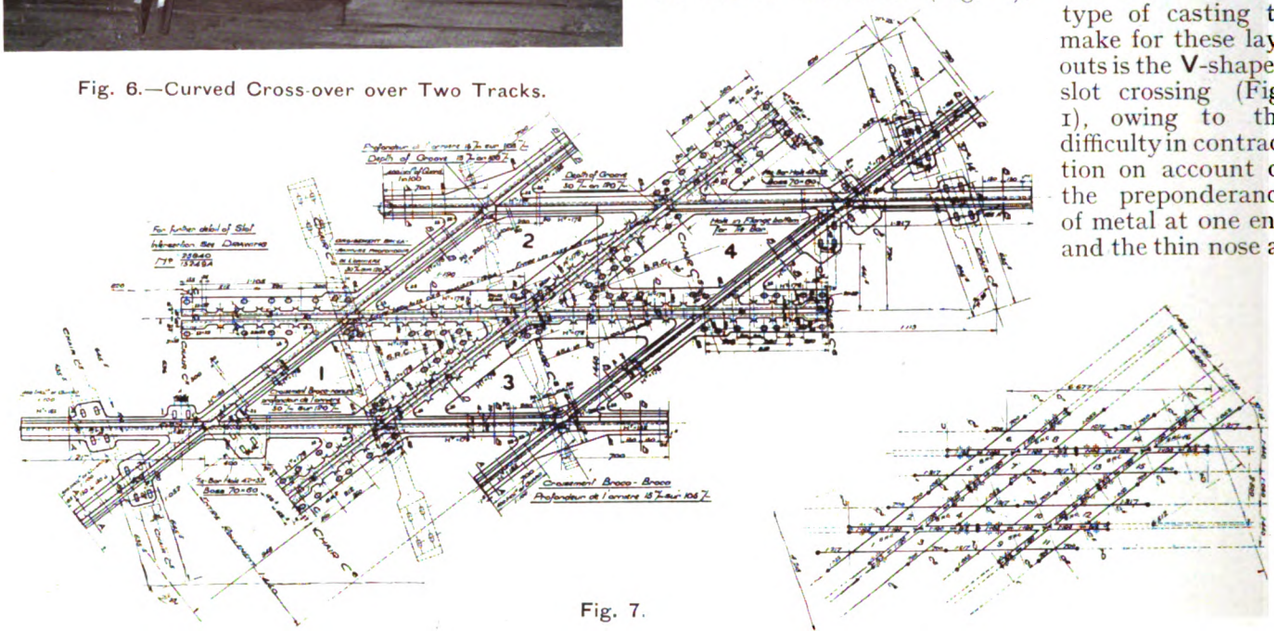

Fig. 7.

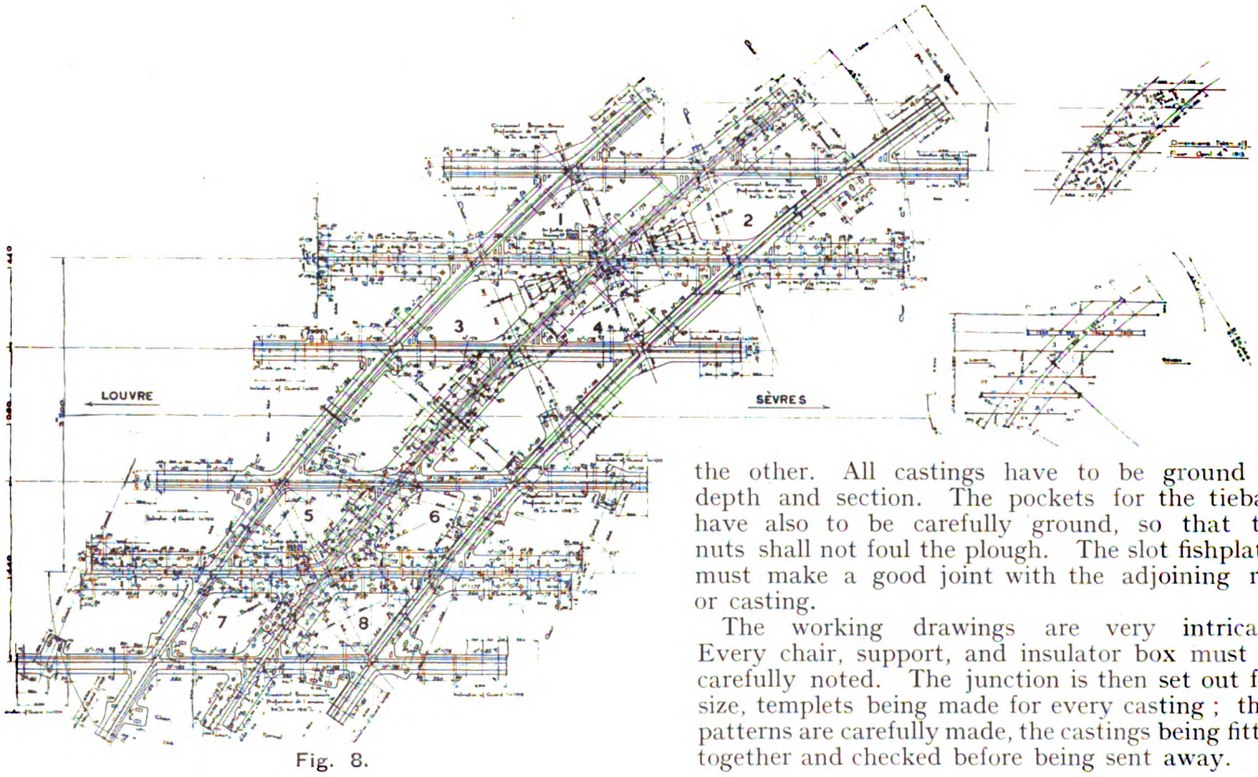

Fig. 8.

The working drawings are very intricate. Every chair, support, and insulator box must be carefully noted. The junction is then set out full size, templets being made for every casting; then patterns are carefully made, the castings being fitted together and checked before being sent away.

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The Thomson-Houston Company have endeavoured to standardise the crossovers as far as possible, so as to reduce the enormous amount of pattern making which would otherwise be required.

CARS WITH FRONT ENTRANCE AND CENTRE EXIT.

The need for time saving in loading and unloading cars, which has so often been urged in these pages, is being more keenly felt everywhere. Recently we reported what had been done at Newcastle to improve the means of entrance and exit, and we have only recently learned that similar methods are being tried in Ayr. In the United States one of the latest car designs provides a front entrance and centre exit. *Electric Traction*, of Chicago, gives the following description of 50 cars of this type recently ordered for their Rochester lines by the company known as the New York State Railways. These cars will be of all-steel construction, with plain arched roof, and will be 50 ft. long over all. They will seat 54 persons.

The roof will be made up of a steel plate covered with cork and canvas, this being one of the latest types of roof construction. The posts and carlines will be made of steel T-iron—a single piece of iron forming two posts and one carline, the upper part being bent to the proper curve of the roof. Grab handles for standing passengers will be supported from brackets on the side posts, and these handles, together with all pipes, rails, and stanchions, will be coated with white enamel.

The front entrance will be divided by a stanchion and dividing rail, which will permit two passengers to enter side by side, and will greatly facilitate loading in the crowded districts during the rush periods. The front entrance will be enclosed in folding doors manually operated and controlled by the motorman. A folding step is also operated in conjunction with the doors. The centre entrance will also permit of two or more persons leaving the car side by side. There will be a well at the exit and two sliding air-operated doors controlled by the conductor.

The fare box and conductor's stand will be located just forward of the centre exit. All passengers will pay their fare as they pass the fare box—those taking seats or standing in the forward part of the car not depositing the fare until they leave the car at the centre exit on reaching destination. Passengers going to rear of car on boarding or at any time during the journey will deposit fare as they pass the fare box in going from the front to the rear of the car.

The floors will be of two thicknesses of seasoned maple with a layer of building felt between. The upper floor will be of grooved boards running crosswise of the car. The floors will be ramped slightly from the bolster position to the centre well with one step from the car floor into the well. The distance from the floor of the well to the street will be 13 in. The motorman's cab will be enclosed.

The seats will be longitudinal. There will also be a seat around the rear end of the car. The space between the car floor and seat cushions will be enclosed by a thin plate of sheet iron, leaving only the centre portion of the car floor open, which will greatly facilitate the keeping of the car floor in a clean condition.

Cars will be lighted by a circuit of five 93-watt tungsten lamps with velvet reflectors. Each car will be equipped with five ventilators attached to the centre of the roof, and the lamp fixture will be attached to the centre of each ventilator.

The car bodies will be mounted on single trucks, with 5 ft. 2 in. wheel base, 26 in. wheels, 4 in. axles, and semi-elliptical springs. The trucks will weigh approximately 4,300 lb. The electrical equipment will consist of four GE-258-A motors with GE-K-12 controller, with contactor line switches. Straight air-brake equipment of the National Brake and Electric Company with National M-W-1 compressors (10 cu. ft. capacity) will be installed.

The cars will be equipped with Hale and Kilburn seats, Cincinnatti Car Company's standard ventilators, and Consolidated Car Heating Company's forced ventilation hot-air heaters.

BELFAST TRAMWAYS MANAGERSHIP.

Six of the 42 applicants for the position of general manager of the Belfast Corporation Tramways, the vacancy having been caused by the resignation of Mr. Andrew Nance, have been selected for further consideration. The applications came before a meeting of the Tramways and Electricity Committee held on May 17, when they were referred to a sub-committee for consideration and report. The six candidates remaining on the list are:—Mr. James Scott Duncan Moffet, general manager of the West Ham Corporation Tramways; Mr. William James M'Combe, tramway manager of Hull; Mr. Robert Stuart Pilcher, general manager and engineer to the Aberdeen Corporation Tramways; Mr. Joseph Fitzalan Simpson, engineer and general manager, Preston Corporation Tramways; Mr. Joseph W. Dugdale, late tramways general manager and engineer, Oldham; and Mr. Richard Henry Wilkinson, general manager and engineer, Corporation Tramways, Huddersfield.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

ARRANGEMENTS FOR THE CONGRESS.

For the annual congress, to be held on Friday, June 30, the following arrangements have been made:—

2.30 p.m.—Annual general meeting, Westminster Palace Hotel, S.W.

3.0 p.m.—Paper by Mr. W. Tuke Robson, A.I.E.E., general manager, Southampton Corporation Tramways, on "Tramway Transit and Comfort: A Plea for the Passenger." Discussion to follow.

4.0 p.m.—Visit by special motor omnibuses to the London General Omnibus Company's Training School at Milman Street, Chelsea, where members will be received by Mr. H. E. Blain, operating manager of the London General Omnibus Company and the Underground Railways.

Inspection of class-rooms, drivers' and conductors' courses, mess-room, clothing stores, etc., and cinematograph hall, where special films will be exhibited showing London traffic scenes with special reference to rules of the road for tramcars, omnibuses, and other traffic, methods of training, etc.

This will be followed by tea, during which Mr. Blain will give a short address on "The Safety Movement."

7.30 for 7.45 p.m.—Members' dinner at Trocadero Restaurant.

The Hon. Arthur Stanley, M.P., will preside at the dinner, which is intended to be an informal one.

At the annual meeting the names of the following gentlemen will be submitted for election to the Council:—Mr. H. M. Sayers, consulting engineer; Mr. I. Bulfin, general manager, Bournemouth Corporation Tramways; Mr. W. Vincent Edwards, general manager, Hastings and District Tramways Company; Mr. G. M. Harriss, general manager, Dublin United Tramways Company; Mr. A. W. A. Chivers, British Electrical Federation, Limited; Mr. A. H. Beatty, director, Messrs. Balfour, Beatty and Company.

MUNICIPAL ELECTRICAL CONFERENCE.

The twenty-first annual general and other business meetings of the Incorporated Municipal Electrical Association will be held on June 22 and 23 at the Institution of Electrical Engineers, London. On the first day the programme will be as appended:—

10.0 a.m. (1) Presidential address. Mr. Alex. C. Cramb, borough electrical engineer, County Borough of Croydon.

(2) Paper on "Boiler-house design," by Mr. W. W. Lackie, past president, engineer and manager, Glasgow Corporation Electricity Department.

2.30 p.m. (1) Paper on "Area of supply from an economic standpoint," by Mr. H. S. Ellis, borough electrical engineer, South Shields.

(2) Paper on "The application of electric power to agriculture," by Mr. W. T. Kerr, city electrical engineer, Hereford.

On the second day the routine business will be transacted.

YORKSHIRE TRAMWAY MANAGERS' ASSOCIATION.

INSPECTION OF THE BRADFORD TROLLEY BATTERY VEHICLE.

A meeting of this association was held in Bradford on Thursday, June 1, the following members being present:—Messrs. C. J. Spencer (Bradford), J. B. Hamilton (Leeds), E. Cross (Rotherham), W. E. Nicoll (Barnsley), J. V. Moinet (Scarborough), R. H. Wilkinson (Huddersfield), W. McGibbon (Ossett), J. W. Hame (York), E. A. Paris (Dewsbury), H. L. White (Clecthorpes), J. W. Galloway (Halifax), J. D. Caird (Halifax), J. Parkinson (Dewsbury), C. J. Jewell (Wakefield), H. England (Wakefield).

Luncheon was provided at the Great Northern Victoria Hotel, and afterwards the members adjourned to the Tramway Offices, when a discussion was opened by the Chairman (Mr. C. J. Spencer), who gave a description of the new trolley battery vehicle which is referred to elsewhere in this issue. An interesting discussion followed on the transit of goods in general, and the adaptability of this vehicle in particular for delivery of goods to places adjacent to tramway tracks.

Among other questions discussed were trailer cars, women car drivers, and the liability of serious accidents through hand brake handles slipping. The members then journeyed in a special car to Rawson Square, and there inspected the trolley battery vehicle.

A hearty vote of thanks to Mr. Spencer for so kindly making such complete arrangements for the meeting, and the facilities he had given for a demonstration of the new vehicle, was accorded.

Large Increase of Trailer Cars in London.—It was stated at a meeting of London County Council on May 30 that there are now 116 trailer cars in use on the Merton, Norbury, New Cross, and Woolwich routes. The women conductors in the Council's employ at the date mentioned numbered 739, and the number is being increased.

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THE
Tramway and Railway World

FOUNDED IN 1892 AND PUBLISHED BY
THE TRAMWAY AND RAILWAY WORLD PUBLISHING COMPANY, LIMITED,
AMBERLEY HOUSE, NORFOLK STREET, LONDON, W.C.

SUBSCRIPTION:

THE TRAMWAY AND RAILWAY WORLD can be obtained, post free, at the following rates:

FOR THE UNITED KINGDOM Twenty-five Shillings per annum

THE ANNUAL SUBSCRIPTION INCLUDES 64 ISSUES, OF WHICH 12 ARE ILLUSTRATED NUMBERS.

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Single Copies One Shilling (Postage, 2 pence—Abroad, 5 pence).

THE EDITORIAL AND PUBLISHING OFFICES OF THE TRAMWAY AND RAILWAY WORLD ARE AT AMBERLEY HOUSE, NORFOLK STREET, LONDON, W.C.

Telegraphic Address: "TRAMIGRO, LONDON."
Telephone No.: GERRARD 2048.

LONDON, JUNE 8, 1916.

A Mineral Railway Electrification.

An absolute novelty so far as this country is concerned, and one of the few examples of installations of the kind to be found anywhere, is the electrification of the mineral line of the North Eastern Railway Company from Shildon to Newport. An examination of the detailed description and numerous illustrations, which appear in this issue, will show that the equipment presents a number of departures from ordinary practice. In the first place, direct current at a pressure of no less than 1,500 volts is used. Hitherto the highest direct-current voltage employed for traction in England has been 1,200 volts, namely, on the Manchester to Bury line of the Lancashire and Yorkshire Railway, recently described in our pages. We except the notable high-tension installation on the Bury to Holcombe Brook line, as this was constructed for experimental purposes. The Manchester to Bury equipment includes a third-rail conductor, but the Shildon-Newport line has overhead wire conductors after the style—though differing in detail—of those used for high-tension single-phase traction. In America two important installations of electric traction on the high-pressure direct-current method for heavy trains have been put into operation recently. On the Butte, Anaconda, and Pacific Railway the working pressure is 2,400 volts, and on the Chicago, Milwaukee, and St. Paul Railway it is 3,000 volts. The latter is the same pressure as is used on the experimental line between Bury and Holcombe Brook, and if the use of direct-current traction on railways in this country extends, the voltages employed will no doubt tend to approximate to this pressure. Though the electric locomotives used on the Shildon-Newport line are small compared to some American ones, they are the most powerful in use in this country. Each weighs 74 tons, and is designed to haul a train of 1,400 tons at a normal speed of 25 miles an hour on the level. There are four motors of 275 H.P. each. The conditions on the line are very favourable, as all the loaded coal trains go down from Shildon to Newport, over most of which distance there is a falling gradient. The up trains as a rule will be lightly loaded or empty. In the case of the two American railways already mentioned, the conditions are different in various respects. In particular, provision has to be made for hauling the enormous mineral trains characteristic of American practice. The bigger the train the lower the costs per ton-mile—such seems to be the experience in the United States. The average weight hauled by a Butte-Anaconda locomotive is 2,100 tons, while the maximum appears to be 3,700 tons. The machine is a double unit weighing 144 tons. The Chicago-Milwaukee locomotive weighs 250 tons, has a continuous rating of 3,000 H.P., and draws a train of 2,230 tons up considerable gradients. Reports show considerable economies as compared with steam traction; the trains are heavier, and the speed is greater. The North Eastern Railway Company have an advantage similar to that enjoyed by the two American railways mentioned, as they are able to purchase energy at a cheap rate from great electric power companies. It may be hoped that the directors will in the near future make public a comparison of the financial results of electric and steam operation on this line. Among other points to which special attention may be directed is the description of the sub-station equipment. The rotary converters are arranged two in series to produce the pressure of 1,500 volts, and the switch-gear presents some unusual features, as

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on the direct-current side the above-mentioned voltage has to be provided for instead of the usual 500 or 600 volts. The working of the installation will be followed with keen interest.

Conveyance of Goods. Now that the Government are taking definite steps to regulate the consumption of petrol, in order to prevent waste, we cannot refrain from again calling attention to the question of using tramways for goods transport. If the requisite facilities had been available, an immense service in economical transportation would have been rendered to the nation during the progress of the war, while the money sent out of the country for the purchase of thousands of American road motor vehicles, to meet the shortage of horses and the congestion of the railways, would have been available for national use. Among the greatest gainers would have been the railway companies, whose opposition has been mainly responsible for the failure of tramway owners to link up their lines with goods termini. When once accomplished, this would have led to the extension of the rails into the yards of numerous industrial undertakings. In later years, smaller works would have found the battery runabout an economical means of bridging the space between their wharves and the track. Electric cranes on the goods wagon would have swept away the street obstruction created by the out-of-date vehicles of the railway carriers. Indeed, goods transit by tramway would have afforded a capital field for the adoption of modern methods, from the box carrier to automatic sorting at suitably designed and adequately equipped and approached clearing houses. Added to this we should now have had the benefits that promise to accrue from Mr. J. C. Spencer's experiment at Bradford with a combination railless trolley and battery vehicle, using the overhead wire of a tramway where one exists and relying elsewhere upon the automatically boosted accumulators. This innovation, which is described and illustrated elsewhere in this issue, is the outcome of the lack of both railway and private cartage facilities. Throughout the country there have been delays of weeks and months in the delivery of minerals and goods, and this has occurred at a time when a committee of managers are controlling the principal railways for the Government. For this and other reasons tramway operators should regard it as incumbent upon them to take steps to utilise their lines for goods traffic in towns where the local Act gives the power. We are glad to notice that Mr. J. B. Hamilton is preparing a report for his committee on the prospects of making such use of the Leeds tramways, especially in districts situated long distances from railway and goods termini. Mr. Hamilton rightly observes that by utilising the tramways to convey minerals and goods to those localities a saving would be effected in cost, while the wear and tear of the highways would be reduced. Probably at this juncture it might be possible to advance the scheme for cotton transport by tramway between Liverpool and Manchester, a project that has twice occupied the attention of the tramway authorities of the Mersey Port and of intervening districts. In London a great amount of traffic might be taken off the roads by utilising the tramways for goods conveyance ; the lines pass most of the chief railway depots.

The Summer Time Act. Traction undertakings will be the gainers in two ways by the operation of the Summer Time Act, which took effect at 2 a.m. on May 21, when clocks were advanced an hour beyond Greenwich time. In common with all users of artificial light, the undertakings will experience a reduction of expenditure on illuminants, and the saving will be further enhanced by the lessening of the deterioration of incandescent electric lamps entailed by the varnishing of the globes to comply with the lighting restrictions. It was chiefly in order to effect economy in lighting that the Act was accepted by Parliament at the instance of the Government. From the realisation of that aim the country will gain the still greater advantage of lessening the demand upon the reduced output of coal from the mines, with their smaller number of workers. The importance of releasing coal, so that it can be used for the supply of power to munition works and to serve the needs of the Allies abroad, requires no emphasis beyond stating that it is a consideration more forcible than any that has been advanced since the late

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Mr. Willett suggested the introduction of the Daylight Saving Bill in 1907. The appeal for economy that is now pre-eminent had no influence prior to the outbreak of the war. This is shown by the fact that during an investigation into the probable effects of the Bill by a Parliamentary Committee, it was stated that the annual saving for the whole country would amout to £2,500,000, inclusive of £92,000 by the railways and £10,000 by the tramways department of the London County Council. No doubt the greatest obstacle to the innovation was the difference between railway time in this country and on the Continent. That hindrance has now disappeared, consequent upon almost universal acceptance of the measure. An unlooked for difficulty has arisen now that the measure has come into force. We refer to the higher charges for lighting announced by some electricity companies owing to the reduction in their revenue. This result, however, may be attributed to the special circumstance of the dearness of fuel at this period. For a second form of profit from the Act transit authorities will probably be justified in looking for an increase of pleasure traffic during the extra hour of daylight now at the disposal of the workers. Several considerations might be cited why people are likely to be influenced in that direction ; the anticipated gain would be greater if the Bill had been enacted earlier. This defect is capable of being remedied if the war is unhappily in progress next year, for the Act provides that in any subsequent year of the conflict its clauses may be revived for such period as may be fixed by Order in Council. Judging by the manner in which the Act has been welcomed, and the lack of inconvenience resulting from it, the question of its retention on the statute book after the war is not likely to be challenged.

Manchester-Bury Railway Electrification.—The electric railway service on the Manchester and Bury section of the Lancashire and Yorkshire Railway was inaugurated on April 17. A full description of the work, together with 56 illustrations, appeared in our issue of January 13 last. The new service has effected a considerable reduction in the journey time.

Electrical Trades After the War.—The Board of Trade have appointed the following committee to consider the position of the electrical trades after the war, with reference to international competition, and to report what steps, if any, are necessary or desirable in order to safeguard the position : -Hon. Sir C. A. Parsons (chairman), Mr. J. Annan Bryce, M.P., Mr. T. O. Callender, Mr. James Devonshire, Mr. B. M. Drake, Sir John Snell. Communications should be addressed to the Secretary, Electrical Trades Committee at 7, Whitehall Gardens, S.W.

TRADE AFTER THE WAR.

The Government have made no advance during the past month, so far as public announcement is concerned, in regard to fiscal arrangements after the war. The statement which Mr. Chamberlain, Secretary for India, made in the House of Commons on May 18 was merely a repetition of what some of his colleagues had said before—encouraging as far as it went, but unsatisfactorily vague. The whole subject is to be examined from a new standpoint, and the British representatives are to go to the International Economic Conference unfettered. Dissatisfaction has been expressed with the composition of the two trade-after-the-war advisory committees appointed by the President of the Board of Trade to advise as to the iron and steel and the textile industries. In short, the Government attitude is not so hopeful as it might be, nor is the position rendered more encouraging by the fact that Mr. Harcourt is taking Mr. Runciman's place at the Board of Trade, while the latter is recovering from a breakdown brought on by overwork and strain. Mr. Harcourt has so far given little indication that he realises the great danger with which British trade will be confronted after the war, unless well considered action is taken beforehand.

On the other hand, invaluable help is being given in awakening public opinion by Mr. W. M. Hughes, Prime Minister of Australia, who continues his indefatigable campaign in this country in favour of fostering British Empire trade, and of excluding German trade. Perhaps one of his most notable utterances was that addressed to a patriotic labour demonstration in the Queen's Hall, London, on May 10. It was a trumpet call for the national organisation of our industries, and it was also a demonstration of the hopelessness of the old policy of *laissez faire*. Even more striking was the enthusiastic reception of Mr. Hughes at Manchester where, in the home of Cobdenism, he denounced the old policy as outworn and hopeless. This was on May 26, or only three days after the announcement was made that 932 members of the Manchester Chamber of Commerce had voted in favour of a policy of trade protection against our enemies, and only 234 had voted in opposition. The significance of these figures can scarcely be overlooked even by the Government.

The country is indeed waking up from its long slumber, and if the Government fail to heed the portent there will come a sudden day of reckoning. Another significant matter is the proposed formation of a comprehensive body to be called the United British Industries Association. Backed by many of the most influential companies, firms, and associations connected with British industry, it is hoped that this body will embrace practically all the industries of the nation, and that it will be able to exercise a powerful influence for good on the trade policy of the nation. The formation of a Ministry of Commerce is likely to be one of the points pressed. The national organisation of industry for which Mr. Hughes contends ought to be within the reach of such an association. The chemical manufacturers of the country are also forming a new organisation of their own ; the promotion of technical education will be one of the main objects of this body. Mr. T. C. Elder, of the "Beama," continuing his addresses on trade after the war, particularly engineering trade, lectured under most influential auspices at the Royal Technical College, Glasgow, on May 16. Meetings of various classes of traders are being held all over the country for the purpose of considering and taking action which will prevent a recurrence of German trade domination and promote British Empire

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commerce and also trade with our Allies. All the indications are that if necessary the hands of the British Government will be forced by the nation.

THE ECONOMIC CONFERENCE.

Mr. Bonar Law has elucidated to some extent what will be the position of the Allied Governments' representatives at the forthcoming International Economic Conference, which, as now arranged, will be convened at Paris on June 14. He told a deputation from the Associated Chambers of Commerce that the British representatives—who, it is highly satisfactory to know, will include the Prime Minister of Australia—will go to the conference on precisely the same footing as the members of any of the other Governments. The British representatives will go with a desire to evolve some policy of advantage to the Empire.

Probably by way of a preliminary to the conference, a gathering took place in Paris in the end of April of what is called the International Parliamentary Committee of Commerce. It consists of a number of the members of each of the Legislatures of the allied countries, and it has been discussing various commercial and trading questions with the object of future safeguards against the predatory Empires. Notwithstanding the adjournment of Parliament until June 22, this month promises to be marked by a steady advance toward the formation of a definite policy. The most stubborn free traders are giving up their uncompromising attitude under the constant pressure of events, and the policy which we have so long and so stupidly followed, to our own great detriment, must soon be abandoned.

EDINBURGH AND A MUNICIPAL TRAMWAYS MANAGER.

On May 31 the sub-committee of Edinburgh Tramways Committee considered a motion by Bailie Boyd as to the advisability of appointing a tramway engineer during the remainder of the tramways lease. Mr. Campbell, the burgh engineer, stated that he was able to discharge the duties at the present time, as much of his own work was in abeyance. The sub-committee decided to defer the question. Councillor White submitted a motion recommending the Corporation to appoint a tramways manager and to establish a tramways department. He urged that an expert should be secured to devote his whole time to the work in view of preparing for the transfer of the undertaking and its extension, as well as deciding upon the method of traction. The sub-committee remitted the matter to the Tramways Committee.

THE REBELLION IN DUBLIN.

EXPERIENCES OF THE UNITED TRAMWAYS.

On Easter Monday, April 24, at 12.30 p.m., immediately after the Sinn Fein rebels had occupied the principal public buildings in Dublin, the Tramways Company

Tramway Standard Pierced by Shell.

started withdrawing their cars from the streets, and at 2.30 p.m. most of the vehicles were returned safely to the different depots. In Sackville Street one of the Howth cars was stopped and the motorman and conductor were covered with revolvers and ordered to leave. An endeavour was made to upset this car by hand to form a barricade for Earl Street, but the attempt failed. Then a charge of dynamite was put beneath it and exploded, but it did little or no harm. Eventually this car was burnt owing to the adjoining houses having caught fire and fallen upon it. Another

Tramcar Destroyed During the Insurrection in Dublin.

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car was caught on the South Quay and was also burnt in the same way. Minor damage to four or five of the cars was done by rifle fire.

There was no direct attempt to damage cars except for the rebels' "military" purposes. One motorman, however, in running his car out of the danger zone, was seriously wounded, while another employee, who was coming from a city depot, was killed by rifle fire from the General Post Office. Several tramwaymen were wounded by stray bullets in the vicinity of their homes.

The trolley wires suffered most severely; several miles were brought down all over the city by rifle fire. Several tramway standards were damaged by shell fire. The accompanying photograph shows one at the corner of O'Connell Bridge and North Quays, from which it will be seen that a shell passed right through the pole. Subsequently this standard, as well as the others damaged, were filled up with concrete reinforced with steel rods on site.

The day after the outbreak the Sinn Feiners surrounded the power station, and eventually entered and ordered the employees to leave. All the intruders carried revolvers, and some of them displayed a revolver in one hand and a dagger in the other. They gave the engineer on duty an hour to clear out, under penalty of death, and ordered that the whole of the works were to be shut down. This was exactly what the management had decided to do themselves. The rebels were apparently satisfied that their wishes were carried out, as they did not return. The staff, however, kept in occupation of the station in its shut-down state throughout the whole of the fighting, notwithstanding the heavy rifle fire in the district, which was one of the most stubborn in resisting the troops and was the last to be conquered. No attempt was made to do any damage to the power station.

On May 2, immediately after the burning of the General Post Office, the fires in the power station were restarted, and on May 3 the greater part of the undertaking was in working order. Sniping was very prevalent throughout the whole of tramways area, which made it uncomfortable for the men repairing the overhead wires, but by May 5 practically every feeder was temporarily repaired and the full car service was restored as far as the military authorities would allow it to be run. General Maxwell had drawn a cordon around the whole city, and would not allow the cars to pass more than two bridges—one on the south side and one on the north side.

The amount of the damage to the rolling stock, including the two cars destroyed and injuries to six other cars—mainly breaking of glass by rifle fire—did not much exceed £1,500. The total damage to the overhead equipment amounted to about £500. Considering, however, the amount of property that the company owns throughout the city, such as the various depots, and the large number of cars, the shareholders may be congratulated on their good fortune in escaping so lightly. The actual stoppage of the services was from 12.30 p.m. on Easter Monday, April 24, until May 3, and this cessation of traffic constituted the company's most serious loss.

The second photograph shows the Howth car already referred to as having been burnt. This car, as well as a smaller one destroyed on the South Quay, was eventually towed home on its own wheels. The field coils were rendered useless, but the armatures are apparently not very much the worse. Notwithstanding that the metal melted from all the bearings, the two trucks are not beyond repair. No damage was inflicted on the truck as the result of the attempt to blow the car up.

HULL TRAMWAYS.

Visit by the Municipal and County Engineers.

A meeting of the Institution of Municipal and County Engineers was held at Hull on May 13, when the members were welcomed by the Lord Mayor (Alderman Hargreaves), who is chairman of the Tramways Committee. Mr. F. W. Bricknell, the city engineer, read a paper descriptive of the municipal works of Hull. Adverting to the tramways, he said the power-station was now equipped for a uniform three-minutes' service. The most recent overhead equipment was carried on span wires, and he regarded the centre standards, which were used at the outset, as a mistake. During the visits to places of interest the visitors inspected tramways with special ballasted tracks on Holderness Road and Hessle Road. The tramway power-station and the electricity works were also visited.

In the course of the discussion on the paper, Mr. W. J. Steel (city surveyor and permanent way engineer at Newcastle) congratulated Mr. Bricknell on the exceedingly low cost of tramway construction in Hull. The Hull tramways were one of the cheapest undertakings as regards cost, and there were several reasons to account for that. For its population Hull had the shortest mileage of any undertaking. There was also an absence of bad gradients, the stiffest being 1 in 100, whereas if the average was 1 in 12 the best rails would wear out in four or five years. Although the bulk of the track had been in use for seventeen years, he understood that very few rails had had to be renewed.

Mr. H. P. Foster (Leeds) remarked that Hull was one of the few towns that had adopted the centre grooved rail and longitudinal sleepers. He asked whether the corrugations were superficial or deep.

In reply to a vote of thanks, Mr. Bricknell said the tramway rails were supplied by a Belgian firm, and were contracted for with the ends cut on the bevel. British firms now gave them the length of 60 ft., which they desired, and also cut the rails as required. Wood setts had long been used in the place of the expensive granite setts. He regretted that they did not put down their creosoting plant for blocks. Adverting to corrugation, he said the rails distributed the weight, and there was approximately equal wear on the two sides of the groove. The life of the track might be anything from twenty to twenty-five years. Gradients undoubtedly made a difference in the cost of maintenance, but frequent stopping and starting also had an appreciable effect.

UNDERGROUND AND L.G.O. GROUP.

The Graphic Presentation of Operating Data.

At the monthly efficiency meeting of the London Underground Railway and London General Omnibus Group, held at the L.G.O.C. Training School, Milman Street, Chelsea, S.W., a paper on "The Graphic Presentation of Operating Data" was read by Mr. H. E. Beech, of the L.G.O.C. General Superintendent's Department, there being a good attendance of officials.

The chair was occupied by Mr. H. E. Blain, the operating manager, who observed that the past two years had been noticeable for the very great improvement that had been effected in the graphs and diagrams used in the department, which had enabled the huge mass of operating data to be presented in a form at once easy to comprehend and clear in exposition.

Mr. Beech's paper was illustrated by a large number of slides, commencing with some of the striking posters which have been utilised to show the various speed rates of different types of vehicles used in London transit. The subject was divided into sections:—(1) Curves; (2) vertical diagrams; (3) describers; (4) other graphical methods. Included in the first group were examples of omnibus loading diagrams, charts showing mess-room operations, the movement of employees at Woolwich Arsenal with the traffic facilities afforded, quarterly route averages in successive years and progressive averages on new routes, rotary railway charts, omnibus petrol consumption charts, and train and omnibus declaration curves. Group No. 2 included traffic analysis, loading diagrams of several descriptions, accident diagrams, diagrams showing journeys per head of population of large cities, and comparison of rapid transit facilities. Group No. 3 showed some novel forms of describers that had been perfected for such work as the allocation of vehicles from a large number of garages to different routes. Group No. 4 included different types of diagrams for plotting and checking headways, graphs showing comparison of vehicles used in different years, combined cartoons showing routes geographically with loadings on omnibus and railway facilities in the area, etc. The actual forms from which the illustrations had been prepared were laid out as exhibits, and both the inspection and criticism of the same evoked considerable interest.

The next meeting of the series will deal with "Time-Tables and Duty Sheets: Comments and Criticisms on Methods and Practice."

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OLDHAM AND MEXBOROUGH MANAGERS.

Mr. Percy Priestly who has recently been appointed general manager of Oldham Corporation Tramways, served his apprenticeship with the late Sir William Allan, in Sunderland. He was for six and a half years deputy electrical engineer at the Halifax Corporation electricity works, and was then appointed general manager and engineer of Mexborough and Swinton Tramways Company.

Mr. Percy Priestly
(General Manager, Oldham Corporation Tramways).

This company was then operating its lines on the Dolter surface contact system. This method of traction became unsuitable owing to the subsidences often occurring in colliery districts, and on Mr. Priestly's advice it was replaced by the overhead trolley. The work was carried out by Mr. Priestly in the shortest possible time. Mr. Priestly also erected the whole of the overhead equipment and other construction work for the railless trolley undertaking, which was opened in August of last year, and has since proved very satisfactory in operation.

Mr. G. H. Browne who recently resigned the position of acting engineer and manager of Ilkeston Corporation Tramways and

Mr. G. H. Browne
(Manager, Mexborough and Swinton Tramways Company).

Electricity Department, to become manager of Mexborough and Swinton Tramways Company, received his technical training at the Wigan and Manchester Technical Institutions. On the presentation of a thesis on "The Conservation of our Coal Supplies" he was elected an associate of the Institution of Electrical Engineers. He served his mechanical engineering apprenticeship with the Garswood Hall Iron and Coal Company, Wigan, and later received an appointment at the Wigan Corporation power-station. After spending four years there, he accepted a position at Swindon Corporation electricity works, where he remained for five years. In September, 1911, he was appointed deputy borough electrical engineer and assistant manager of Ilkeston Corporation Tramways and Electricity Department, and in October, 1914, was appointed acting engineer and manager.

LEEDS TRAMWAYS AND GOODS CONVEYANCE.

Mr. J. B. Hamilton, general manager, Leeds Corporation Tramways, in presenting his annual report to the Tramways Committee on May 15, observed that since October last the tramways had been utilised for carrying fireclay and coal from the Leeds Fireclay Company's mines at Harehills to their works at Wortley and Elland Road. This commencement in the carriage of goods traffic for the general public, Mr. Hamilton states, marks an important era in the development of the business of the tramways undertaking. In the local Acts of Parliament the very fullest powers for conveyance of goods, minerals, etc., upon the tramway lines have been carefully provided for, and no doubt this will in the future be found to be most valuable in serving the citizens. Owing to the contour of the district, all the railways and canals are placed in the southern half of the city, leaving considerable districts, chiefly residential, which are long distances from the railway and goods termini. A properly devised scheme (adds Mr. Hamilton), by utilising the powers of the tramway undertaking to convey minerals and goods over its routes, would undoubtedly lower the cost of conveyance of materials, and very much reduce the wear and tear of the public highways.

The committee requested the general manager to report fully on the prospects of utilising the tramways in this way.

FAILURE OF THE CROYDON STRIKE.

On May 15, Croydon Council, by 27 votes to 23, rejected a motion that on the strikers returning to work the Tramways Committee be requested to meet a deputation of four ex-employees and an outsider. The committee have had under consideration the conditions of service of the employees and the present fares and tramway services, and propose to report thereon when presenting the annual accounts. The weekly additions asked for by the union amounted to 15s. 7d. and 11s. 7d. for motormen and conductors respectively. One hundred and twenty-six men and ten women, who had been summoned for failing to deliver up their uniforms, have returned the clothing, and some of them have made application for reinstatement. They were taken on at the old rate of pay for the duration of the war. As many as fifty cars were in service on May 20. The committee, Mr. T. B. Goodyer, the general manager, and the staff deserve the thanks of the Corporation and the travelling public for the arduous work that they have performed in keeping the services going. Replying to a question in the House of Commons on May 24, the President of the Board of Trade said that the Chief Industrial Commissioner, who had been in communication with both parties before the strike, was still carrying on negotiations.

GLASGOW CORPORATION TRAMWAYS.

The financial year for all the Glasgow Corporation departments closed on Wednesday, May 31. The following are the traffic statistics for the tramways department for the year just closed :—

		Inc. or dec.
Average track mileage open during year (single) ...	196¼	
Car mileage	24,963,309	+ 748,849
Traffic receipts	£1,149,264 7s. 6d.	+ £78,570 3s. 8d.
Traffic receipts per car-mile	11·049d.	+ ·437d.
Traffic receipts per passenger	·761d.	— ·003d.
Passengers carried	362,371,464	+ 26,110,706
Passengers carried per car-mile	14·516	+ ·629

The following statement gives the number of passengers carried at each fare :—

	Year to May 31, 1916.	Year to May 31, 1915.
½d.	232,871,360 ...	213,165,819
1d.	93,768,671 ...	89,890,042
1½d....	22,712,943 ...	21,384,305
2d.	6,913,560 ...	6,410,027
2½d....	3,075,567 ...	2,834,795
3d.	1,453,771 ...	1,285,605
3½d....	1,382,636 ...	1,136,895
4d.	192,956 ...	153,270
	362,371,464 ...	336,260,758

Since July 1, 1894, when the Corporation assumed the management, the totals are as follows :—Passengers carried, 4,417,319,065 ; miles run, 361,006,250 ; car traffic revenue, £16,060,483 12s. 4d.

Weight of copper received during the year to May 31, 1916, 735¾ tons, and the weight of silver 93½ tons.

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G.E.C. CADET CORPS.

In most of the large and industrial undertakings there are employed considerable numbers of youths between the ages of 15 and 18 years. Many of them have been Boy Scouts, and if they are given the requisite encouragement they will take an active part in making themselves fit for military service when they reach the legal age for enlistment under the Military Service Act. It is, however, desirable that the encouragement take the form of practical support

Officers of the G.E.C. Cadet Corps.

from their employers, and undoubtedly much good work can be done to establish an active cadet corps among the youth of manufacturing undertakings and commercial houses.

A pioneer in this direction is Mr. H. Hirst, the chairman of the General Electric Company, who has instituted the G.E.C. Cadet Corps, and although it has only been formed barely two months, it has reached the established strength. The khaki uniform and equipment have been supplied to the corps by the company without charge. What might have proved an insuperable difficulty in the formation of the corps has thus been removed by the generosity of the directors. The corps is commanded by Captain E. A. Joyce, who has the assistance of Lieut. A. V. Cannon and Second Lieut. W. F. Arnold. The unit, which has received recognition under the War Department's cadet scheme, is attached to the First Cadet Battalion of the Sussex Yeomanry, and is 112 strong. The work has the fullest sympathy of Earl Kitchener, the Secretary of State for War, the Lord Mayor, and other public men.

The training is given in accordance with the "1914 Infantry Training Regulations," and the corps is already displaying marked ability. The cadets are put through a course of shooting once a week at the 10-target range at the Cripplegate Institute. Squad and company drill take place on Friday evenings at the Institute, and by permission of the Inner Temple Gardens Association, drill is engaged in on Saturday afternoons in the gardens on the Victoria Embankment.

The training will not only be of immense value as preparatory work when the cadets come to be called up to the army, but it also has a present day value in developing the physique of the lads. From the General Electric Company we learn that it also contributes considerably towards increased efficiency in business by making the lads take a greater interest in themselves, by accustoming them to discipline, by improving their manners, and by the establishment among them of *esprit de corps*.

SALFORD COUNCIL'S MOTOR CARS.

A special committee of Salford Corporation have issued a report giving the results of their inquiry as to the use made of the motor cars provided by the Council for municipal purposes, and their conclusions on the question of establishing a municipal garage. The committee submitted rules and regulations for the future use of cars belonging to the Corporation. The report furnished the following return of maintenance expenses of motor cars for one year :—

	Average per Mile. d.	£ s. d.	£ s. d.
Wages of chauffeurs	2·68		379 17 9
Material :—			
Petrol	·92	130 17 1	
Lubricating oil and grease	·10	14 11 11	
Tires and tubes	·70	98 1 0	
	1·72		243 10 0
Repairs	·60		84 12 2
Uniforms	·17		24 4 1
Licences and insurance	·37		52 16 8
Housing, including lighting and heating	·37		52 0 0
Water and cleaning materials	·03		4 0 0
Depreciation (20 per cent.)	2·02		286 19 6
	7·96		£1,128 0 2

Total car mileage for 1 year, 34,002 miles.

The annual cost of three horses and vehicles was given as £228, and a statement of the expenditure on horse and motor cab fares showed an outlay of £728 in 1913-14, and of £901 in 1914-15. The Council have adopted the committee's scheme.

Reporting on the subject of establishing a motor garage, the committee, after considering the information received from other municipalities, state that "the time is not opportune for the establishment of a municipal garage in Salford, as such a scheme would involve capital expenditure which, in their opinion, ought not to be incurred at the present time. Whilst this position may obtain your committee recommend that the Crossley landaulette, if not disposed of, and the Morris-Oxford car should be housed or stand at a place or places where the other departments may requisition them at any time when required on terms to be arranged and subject to the suggested rules and regulations for governing the use of the cars. Your committee suggest that for any excess need of cars, which this suggested provision would not meet, arrangements should be made with private owners under contract to supply cars as required."

In a reference to the use of horse vehicles by the Lighting and Cleansing and Parks departments, the committee state that it would be more economical and secure greater efficiency if those departments requisitioned a motor car as required.

The G.E.C. Cadet Corps.

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FINANCIAL REPORTS AND MEETINGS.

Auckland Tramways Company.—The directors have declared a dividend of 7d., less tax, on the ordinary shares.

British Electric Traction Company.—A dividend of 3 per cent. on the new ordinary stock is announced for the year ended March 31.

City of Buenos Ayres Tramways Company.—A dividend of 1s. 3d. per share (being at the rate of 5 per cent. per annum), less income tax, has been paid for the three months to March 31.

Colombo Electric Tramways and Lighting.—On the past year's working a dividend of 10 per cent., free of tax, has been paid after placing £15,000 to general reserve and renewal fund, and carrying forward £8,165.

Improved Position at Colchester.—In consequence of the deficit on the tramways for the past year being only £402, the Tramways Committee have reported that it would probably be unnecessary to ask for aid from the rates.

Lowestoft Corporation Tramways.—The revenue for the year ended March 31 was £9,457, or £2,273 less, owing to the absence of visitors occasioned by the war. Working expenses at £7,052 were down by £882. The net result was a deficiency of £2,669.

Nelson Corporation Tramways.—The net profit for 1915-16 was £1,124 on an income of £10,151, as against £9,299 for 1914-15. Discount tickets have proved a popular feature, and the top-covered cars have been of such service that another is to be added during the present year.

Birmingham District Power and Traction Company.—The annual report gives the revenue for 1916 as £101,909, and the surplus, after providing £9,000 for renewals, £58,738. It is proposed to add to reserve £5,000, pay a dividend on the preferred ordinary shares of 4½ per cent., and carry forward £2,551.

Southport Tramways Company.—The accounts for the year 1915 show a total revenue, including £150 brought forward, of £17,549. After deducting all expenses, appropriating £2,299 for repairs and maintenance, and £500 for renewals, the directors propose to transfer £1,000 to reserve, and carry £141 forward.

Accrington Corporation Tramways.—Traffic revenue for the year ended March 31 reached the sum of 12·86d. per car-mile, while the working expenses were 8·67d. The total receipts were £29,393, as against £27,850, the working expenses being £19,498 as compared with £16,438. Passengers numbered 4,841,334.

Merthyr Electric Traction and Lighting Company.—The revenue for 1915 was £24,685, and after providing for debenture interest, and £2,000 for renewals, the surplus was £5,484, while £723 was brought forward. A dividend of 7 per cent. is proposed on the ordinary shares, adding £1,000 to the reserve, and carrying forward £906.

Rochdale Corporation Tramways.—Despite a decrease in the car miles the gross receipts for the past year increased from £83,401 to £87,908. The net surplus is £3,608, against £4,284 the previous year, although the working expenses have been increased by £3,800 by payments to employees on active service and bonuses and extra income tax.

Nottingham Corporation Tramways.—As the result of the working of this undertaking for 1915-16, the receipts show an increase of £16,000 in advance of the previous year, while the expenditure was £11,000 up. For the relief of the rates £20,350, instead of £22,500, is taken, and £13,000 is set aside for the reserve fund, which stands at £37,000.

Brisbane Electric Tramways Investment Company.—The net profits for 1915, including £5,782 brought forward, were £95,667. There has been placed to a depreciation of investments fund £3,500, and a final dividend of 4s. per share, free of tax, on the ordinary shares is recommended, making for the year 8 per cent. £10,367 will be carried forward.

Tramways and General Works Company.—The report for 1915 states that, including the balance brought forward, the amount now standing to the credit of the profit and loss account is £540, out of which the directors recommend the payment of a dividend at the rate of 4d. per share (less income tax), which will absorb £333, and leave £206 to carry forward.

West Hartlepool Corporation Tramways.—Alderman Martin, chairman of the Tramways Committee, has reported a profit of £1,278 on the tramways last year. This amount had been added to the reserve, which now stands at £5,706. The annual statement of the electricity undertaking shows a net increase in income of £1,295, and a credit balance of £316, against £44 in the preceding year.

Salford Corporation Tramways.—Alderman Linsley, chairman of the Tramways Committee, has informed the committee that the past year's trading gave a net balance in hand of £18,000, whereas they had expected £22,000. The decrease was due to the payment of dependants' allowances, and the increased cost of labour and materials. In order to meet their promise to contribute £22,000 to the rates, the reserve fund would be drawn upon.

Peterborough Electric Traction Company.—For 1915 the revenue totalled £12,560, as compared with £10,967. After deducting all expenses chargeable to revenue, including repairs and maintenance and debenture interest, and setting aside £1,600 to renewals fund, there remains £1,484, which, added to £256 brought forward, makes an available balance of £1,740. This is to be applied in payment of one year's arrears of preference dividend, £1,320; leaving £421 to be carried forward.

Lisbon Electric Tramways Company.—After deducting interest and amortisation due on the debentures, London office expenses, and directors' remuneration, the trading for 1915 shows a net profit of £59,917, which, with £2,883 brought forward, makes £62,800. A final dividend of 2 per cent. is recommended, making 4½ per cent. net for the year, carrying £8,736 forward. In order to meet this year's contribution to depreciation reserve, £25,000 has been transferred to that account from the exchange reserve.

York Corporation Tramways.—For the past year the traffic receipts increased by £5,916. This was the first year of the motor omnibuses, and the combined mileage of the cars and omnibuses was 828,517, as against 766,360 the preceding year. The number of passengers was 8,204,719, as against 6,712,631, whilst the total receipts were £34,887, as against £28,971. The receipts per mile were 10·10d., as against 9·07d. During March the omnibuses carried 50,755, out of a total of 669,425 for the two means of traction, as compared with 592,458 in the corresponding month of 1915.

Johnson and Phillips, Limited.—Presiding at the meeting of this company, Mr. R. W. Blackwell alluded to the improvement in the accounts, which show a trading profit of £69,077. Owing to the conditions under which the company must be carried on for a considerable period to come, a larger dividend than 5 per cent., free of tax, on the ordinary shares, would not be justifiable, although the position of the company was financially sound and steadily improving. There was good reason, under existing conditions, to be satisfied with the future prospects.

Barnsley and District Electric Traction Company.—The revenue for the year amounted to £20,820. After providing for all expenses chargeable to revenue, including £1,675 for debenture and loan interest, and setting aside £2,500 to the renewals account, the surplus is £2,487, including £1,544 brought forward from the previous year. The directors recommend that this balance should be applied as follows:—Dividend for 1915 at the rate of 6 per cent. per annum on preference shares, £1,320; dividend at the rate of 5 per cent. per annum on ordinary share capital, £1,001; leaving £165 to be carried forward.

Satisfactory Year at Blackpool.—For the twelve months ended March 31 the tramway receipts were £80,070, which is the third highest total in the history of the undertaking. The gross profit was £35,036, and after deducting interest and sinking fund payment there was an available balance of £16,275. The record year was in 1913-14, when the net profit was £24,552, the next best year being 1912-13 with £17,664 net profit. As of late years the Tramways Committee have insisted on accumulating an adequate reserve fund, it is not expected that more than £8,000 will be devoted to the relief of the rates. That amount is equivalent to a 4d. rate.

Babcock and Wilcox, Limited.—The directors recommend that the following dividends be paid for the half-year ended December 31, 1915:—3 per cent. on the preference shares, 2½ on the second preference shares, less tax, and 9 per cent. on the ordinary shares, tax free. The sum of £150,000 has been placed to reserve, and £10,000 has been granted to the staff pension fund, leaving £42,125 to be carried forward. Mr. J. Dewrance presided at the annual meeting on May 9. He stated they had £466,000 for appropriation, compared with £476,000 last year. The company were now a controlled establishment, and instead of making boilers and cranes, they were doing work required by the Ministry of Munitions.

Kidderminster and District Electric Lighting and Traction Company.—The net receipts of the lighting undertaking for 1915 were £4,561, and with £3,471 for dividends on investments, and £219 brought forward, the total was £8,251. After deducting expenses, interest on temporary loans and debenture stock, and providing £500 for renewals, there remained £3,708, of which there will be appropriated to reserve £750, to dividend on cumulative preference shares for the past year (already paid) £1,500, and carried forward £1,458. The profit on the tramways, after providing for renewals, was £2,439, which, added to £163 brought forward, left £2,602. This has been dealt with as follows:—To reserve £500, dividend at rate of 3½ per cent. £2,002, carried forward £100.

Cork Electric Tramways and Lighting Company.—Mr. E. Anderson, presiding at the nineteenth ordinary general meeting, stated that the gross receipts had increased by £2,301, or £1,920 in excess of the previous year. The lighting and power receipts were £1,920 in excess. The revenue totalled £63,905. The expenses were £42,415, an increase of £4,457, due to the high price of coal and war allowances to the staff, involving charges amounting to £5,800, equivalent to 5 per cent. on the ordinary capital. After transferring £6,500 to the depreciation and renewals fund, writing off £1,804 for wiring consumers' premises and the depreciation of investments, and paying the preference dividend, there was a balance of £1,560. This was

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to be carried forward, together with £2,480 from the previous year. Mr. H. C. Levis and Captain W. Martindale were re-elected directors.

Bournemouth Corporation Tramways.—The traffic receipts for 1915-16 amounted to £107,818, an increase of £5,472. The car-miles run amounted to 1,670,702, a decrease of 144,930. The receipts work out at 15·49d. per car-mile, as against 13·52d., being an increase of 1·97d. The working expenses totalled £51,796, being at the rate of 7·44d. per car-mile, as against 7·27d. for the previous year. The gross expenses amount to £89,181, as against £90,678, the net balance being £19,337. From this figure must be deducted the allowance made to employees who joined the forces, namely, £4,173, as against £2,352, and the capital charge and deficit on the running of the motor omnibuses, namely, £1,032, as against £1,188 last year, leaving a net profit of £14,132, as against £9,083. The Council at their May meeting adopted the recommendation of Mr. I. Bulfin, the general manager, that £10,000 be placed to renewals, and £1,000 to reserve. The renewals fund stands at £13,000 and the reserve fund at £5,000. Just over £700 has been expended on renewals to cars, overhead equipment, and power plant, and £2,000 on the permanent way. During the past five years the total profits amounted to over £50,000, or an average of over £10,000 per annum. This amount has enabled reconstruction work on several routes to be carried out, resulting in very greatly increased revenue. The permanent way of the main section is satisfactory, but as soon as normal prices prevail it will be necessary to reconstruct it.

Bath Electric Tramways Company.—After providing for the preference dividend, the 4½ per cent. debentures, and the sinking fund, the company's operations for the past year show an available balance of £8,486. At the annual meeting the directors recommended that that sum should be added to the reserve for depreciation and renewals. The loan from the bank had been brought down to £16,000. Originally it was £28,000. Sir J. Sivewright, who presided, said the receipts showed a decrease of £5,558, which was largely attributable to the reduction of the road motors in the latter part of 1914, when a large number were transferred to the military service. Economies in operation and expenses more than offset the diminution in receipts, so that they had a greater net revenue. The plant, rolling stock, and permanent way were all in an efficient condition. Two hundred and twenty-one employees had either joined the forces or attested. The gross balance was £20,085, and the net balance £8,486. The reduction of the loan had improved the value of the shares. There was a promising future before the company, and if they pursued their present policy they would have an improved motor fleet and their foundry would be extended. They had a splendid business. Colonel H. F. Clutterbuck was re-elected a director.

London County Council Tramway Accounts.—The report of the District Auditor on the accounts of the London County Council for the year 1914-15 gives the following comparative statement of tramways income and expenditure:—

	Year ended March 31, 1914.		Year ended March 31, 1915.	
	Income.	Expenditure.	Income.	Expenditure.
	£	£	£	£
Electric traction	2,247,043	1,585,251	2,389,046	1,684,244
Horse traction ...	21,626	30,215	10,801	16,328
	£2,268,669	£1,615,466	£2,399,847	£1,700,572

For the year ended March 31, 1915, the expenditure included a charge of £42,209, covering allowances made to officers and employees in the tramways department who were serving with the forces. The surplus on revenue (working) account for 1914-15 amounted to £699,276. The net revenue account showed a deficiency of £33,173, which has been met out of the general reserve fund. In regard to this fund the auditor remarks that the Council on June 23, 1908, agreed that provision should be made for renewals at the rate of two-thirds of a penny per car-mile run, this basis to be reconsidered at the end of five years. It was also agreed that the balance remaining on the net revenue account, after providing for renewals on the basis referred to, should be carried to the general reserve fund for providing for general contingencies. Owing to the changed financial position of the undertaking, reconsideration of the subject has been postponed to April 15, 1917. Full provision was made on the original basis up to the year ended March 31, 1912. In the following year the sum required to be provided was £150,309, but the sum available was only £497. There were deficiencies on the net revenue accounts for the years ended respectively March 31, 1914 and 1915, and no provision for renewals has been made during those two years. The balance of the renewals fund on March 31, 1915, was £402,045. The general reserve fund on March 31, 1915, amounted to £163,050. The aggregate capital expenditure to March 31, 1915, amounted to £13,315,723, made up as follows:—

In respect of electric traction	£11,189,215
In respect of horse traction	142,399
In respect of obsolete lines	1,984,109

The net debt at March 31, 1915, amounted to £9,836,187.

CONTRACTS AND ORDERS.

Southend Council have ordered six miles of trolley cable from the British Insulated and Helsby Cables, Limited.

Leyton Tramways Committee have placed an order with Messrs. Edgar Allen and Company, Limited, of Sheffield, for a lay-out.

The British Westinghouse Company have received a contract for the supply of traction glow lamps to the London County Council.

W. T. Henley's Telegraph Works Company's tender for the supply of cables for the ensuing year has been accepted by Walthamstow Council.

Nelson Tramways Committee have decided to have five additional trucks fitted with new car bodies by the United Electric Car Company, of Preston.

P. R. Jackson and Company have received an order from Walthamstow for twenty-four commutators for the tramways department, the price being £5 5s. each.

Wolverhampton Council have accepted the tender of Messrs. Strachan and Henshaw, of Bristol, for the installation of ash-handling plant at the electricity works.

Mr. G. P. Wilson has received a contract from Southampton Tramways Committee for brake blocks and castings, at £5 12s. 6d. per ton, an increase of 8s. per ton as compared with last year.

Salford Electricity Committee have awarded a contract to the British Westinghouse Company for the supply of transformers, and to the Underfeed Stoker Company for two mechanical boilers.

Southend Light Railways Committee have placed orders with Mr. D. B. Rose for cars, and with Messrs. R. W. Blackwell for strainers, wire bolts, and mechanical frogs for new overhead equipment on the Leigh route.

East Ham Council have allotted a contract for top dressing granite setts for the tramways to Mr. G. Battersby, at 1s. 3d. per yard super, and to W. Stone and Son, for engineers' sundries for the tramways and electricity departments.

Coal Contracts.—East Ham Council have accepted tenders for 11,000 tons of coal for the electricity works for twelve months at prices ranging from £1 2s. 5d. to £1 8s. 11d. For slack the charges are from 10s. 5d. to 19s. 5d. per ton.

Keighley Council have placed contracts as subjoined:—Dorman, Long and Company, steel girders and other steelwork for foundations of new 5,000 KW. turbo-alternator, £132; H. V. Robinson, Limited, construction of foundations for turbo-alternator, £1,217.

Victorian Railways Department have accepted the tender of Noyes Bros. for Ackley hand brakes at £8 5s. each for new bogie cars for the St. Kilda-Brighton electric railway, and of the Australian General Electric Company for material for railway car lighting.

Manchester Tramways Committee have placed the following contracts:—Bell Punch and Printing Company, Limited, tramcar passenger tickets; Drake and Gorham, Limited, half-watt lamps and drawn-wire filament traction lamps; General Electric Company, Limited, carbon-filament lamps, half-watt lamps, and drawn-wire filament lamps.

Glasgow Tramways Committee have accepted the following tenders:—Points and crossings and special junction work, Hadfields, Limited; chilled-iron brake blocks (three months), Miller and Company, Limited; steel axles (six months), Glasgow Railway Engineering Company, Limited; steel tires (six months), Brown-Bayley's Steelworks, Limited.

Accrington Council have allotted contracts as appended:—British Thomson-Houston Company, 2,000 KW. turbo-alternator, water-condenser, etc.; Lancashire Water Cooler Company, water-cooling tower; E. Bennis and Company, modernising one set of mechanical stokers; J. P. Hall and Sons, boiler-feed pumps; Messrs. Holden and Brook, feed water heater.

London Track and Car Work.—The Highways Committee have reported to London County Council that the value of the special track work obtained during 1915 from Hadfields, Limited, under their contracts was £6,904 17s. 11d. for tramway construction and reconstruction work, and £29,100 14s. 6d. for renewals and maintenance purposes. Tenders were recently received for the supply of driving wheel and pony wheel steel tires, but the committee decided not to accept any of them. The purchase of tramway materials, etc., and the execution of small works and repairs, at an estimated cost of £38,648, has been sanctioned. The committee have authorised the continuance of the employment until October 31, 1916, of a temporary inspector in the chief engineer's department, engaged in supervising the manufacture of rails, at a rate of pay not exceeding £5 5s. a week.

Greenwich Generating Station.—The Highways Committee of London County Council have arranged for blades of a heavier section, laced together, to be substituted for the high pressure blades in the first and second expansions of turbines Nos. 5 and 6 at Greenwich generating station. The new blades are being manufactured by Messrs. Willans and Robinson, the makers of the machines. A pair of grates to be fitted with a new type of stoker link are to be

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obtained, the links being supplied by E. Bennis and Company, Limited. Two machines for breaking up coal are being supplied by W. J. Jenkins and Company, Limited. Tenders for the foundations for the turbo-generators have been obtained, and it is estimated that the expenditure will amount to about £5,250. During the quarter ended March 31, 1916, 36,180 tons of coal for use at the generating station were purchased at a cost of about £48,038.

Shanghai Municipal Council have recommended for acceptance the following tenders:—Scholey and Company, Taylor underfeed stokers, induced and forced draught fans, and chimney for two boilers, £5,370; C. A. Parsons and Company, 10,000 KW. turbo alternator, £32,605; General Electric Company of New York, 10,000 KW. turbo-alternator, £31,720; Fraser and Chalmers, 5,000 KW. turbo-alternator, £16,009; Babcock and Wilcox, eight marine type water-tube boilers, £65,217; Fraser and Chalmers, coal handling plant, £9,867; British Thomson-Houston Company, e.h.t. switchgear for Riverside Works (22,000 volts), £7,575; h.t. switchgear for Fearon Road Station (6,600 volts), £1,565; e.h.t. switchgear for Fearon Road Station (22,000 volts), estimated cost £3,000; Mather and Platt, circulating water pumps for condensers, £3,697; Westinghouse Manufacturing Company, static transformers, £12,300; British Insulated and Helsby Cables, 40,000 yards split conductor e.h.t. underground cables; United States Steel Products Company, steel work for buildings, £8,026.

London County Council Tramways Equipment, 1916-17.—The following tenders for tramway equipment, etc., during 1916-17 have been accepted by the Highways Committee:—

Electrical Equipment (Motor and Generator) Spares.—Alfred Clare and Company, British Westinghouse Electric and Manufacturing Company, Limited.
Electrical Equipment (Controller, Circuit Breaker, and Other Switch, etc., Details and Magnetic Brake) Spares.—British Westinghouse Electric and Manufacturing Company Limited.
Contact Fingers and Parts, Segments, etc.—British Westinghouse Electric and Manufacturing Company, Limited; Dyer and Young; E. Showell and Sons, Limited; Tramways Supplies, Limited.
Electric Cable, Fuse Wire, and Cotton Covered Copper Wire.—Liverpool Electric Cable Company, Limited; Callender's Cable and Construction Company, Limited; British Insulated and Helsby Cables, Limited; London Electric Wire Company; and Smith's, Limited.
Coachpainters' Transfers.—J. H. Butcher and Company; Tearne and Sons.
Copper Bonds.—Watlington and Company, Limited.
Rubber Details.—J. G. Ingram and Son; Irwell and Eastern Rubber Company, Limited.
Moulded Insulators (Other than Rubber).—British Westinghouse Electric and Manufacturing Company, Limited; Crystalate Manufacturing Company, Limited; Ebonestos Manufacturing Company, Limited; Lithodite, Limited.
Fibre Articles.—Micanite and Insulators Company, Limited; L. Andrew and Company.
Track Insulators and Porcelains for Electric Track Work.—Bullers, Limited; Taylor, Tunnicliffe and Company, Limited.
Car Furniture.—J. M. Siddell; Player and Mitchell; E. Showell and Sons, Limited.
Machined Bronze Bearings, Anti-Attrition Metal Company, Limited.
Machine Finished Articles (Brass, Gun-metal, etc.).—E. Showell and Sons, Limited; Player and Mitchell; Anti-Attrition Metal Company, Limited.
Machine Finished Articles (Wrought-iron and Mild Steel).—W. J. Ritchie and Company; British Westinghouse Electric and Manufacturing Company, Limited; J. Holroyd and Company, Limited.
Gear and Pinion Wheels, Ratchets, Worms, etc.—F. W. Rowlands and Company.
Iron and Steel Forgings.—Male and Jordan; W. J. Ritchie and Company; Warren and Sons; Hurst, Nelson and Company, Limited.
Springs.—Crown Spring Company; West Bromwich Spring Company, Limited.
Machined Iron Castings.—J. Holroyd and Company, Limited; J. Crowley and Company, Limited; Peter Hooker, Limited; Carron Company.
Iron Castings.—Sheepbridge Coal and Iron Company, Limited; J. Williamson and Company.
Brake Shoes.—Pease and Partners, Limited.
Machined Malleable Iron Castings.—Bullers, Limited; Leys' Malleable Castings Company, Limited; J. Crowley and Company, Limited.
Malleable Iron Castings.—J. Crowley and Company, Limited.
Steel Castings (Machined and Unmachined).—Edgar Allen and Company, Limited; Hadfields, Limited; S. Peace and Sons, Limited.
Foundry Crucibles, etc. Morgan Crucible Company, Limited.

PERSONAL.

Sir Hiram Maxim has accepted the invitation of the Aeronautical Institute to become their first president.

Sir C. A. Parsons is a member of the committee appointed to inquire into the administration and command of the Air Service.

Mr. A. J. Abraham, general manager of the Aberdare electricity and tramways department, has been granted an increase of salary of £50 per annum.

Mr. Edgar Allen, steel manufacturer, left £32,000 to Sheffield University for the provision of scholarships, half of them to go to the sons of working men.

Mr. H. A. Keli, assistant electrical engineer to Luton Corporation, on the recommendation of the Electricity Committee, has been granted an increase in salary.

Mr. F. P. Dolamore, who acted as deputy to the late Mr. F. W. Lacey for many years, has been appointed borough engineer and surveyor of Bournemouth pro tem.

Mr. A. O. Kolkhurst, general manager, Lisbon Tramways Company, and the entire staff, received the appreciation of the directors in the annual report for their services during the past year.

Mr. C. F. Butler, late acting manager and engineer, Gravesend and Northfleet Tramways Company, has received a War Office appointment as station engineer to a group of generating stations near Salisbury.

Mr. A. L. C. Fell, chief officer of the London County Council Tramways, is, we are glad to state, making satisfactory progress after his serious illness. It is hoped that he will shortly be able to resume duty.

Mr. H. P. Gibbs, consulting electrical engineer to the Government of Mysore, and general manager of the Tata hydro-electric installation in Bombay, has been granted leave of absence to return to the United States.

Mr. G. F. Craven, general manager and electrical engineer, Reading Corporation Tramways, has been recommended for an increase of £50 a year in his salary of £550, to date from April 1 last, instead of January 1 next.

Alderman G. Brodie, for many years chairman of Blackpool Tramways and Electricity Committee, has undergone a long illness. Upon reappearing at the Council meeting in May he was warmly congratulated on his recovery.

Mr. G. Morris and Mr. E. J. Riley, car shed superintendent and chief clerk respectively, Leicester Corporation Tramways, have been awarded increases of salary, the former from £260 to £285, and the latter from £200 to £215.

Mr. W. M. Murphy, chairman of Dublin United Tramways Company, presided at a meeting of property owners and traders held at the Mansion House in that city, at which the Government were asked to lose no time in making good the losses that were sustained during the rebellion.

Alderman J. H. Hargreaves, Lord Mayor of Hull, having accepted the chairmanship of the Parliamentary Committee of the City Council, under a new bye-law of the Corporation, has had to retire from the chair of the Tramways Committee, which he has filled for three years. Councillor W. Wheatley was unanimously elected chairman of the Tramways Committee on May 24, and Councillor Hakes was appointed deputy-chairman.

Mr. W. E. Hardy, general manager and engineer, Bath Electric Tramways Company, and his staff were paid a compliment by Sir J. Sivewright, the chairman, at the annual meeting. Sir James remarked that it was satisfactory to know that the company and their staff had the confidence of the people of Bath. The company were excellently served by their officials and staff, who, without exception, put their heart and soul into the work.

Mr. J. H. Cowell, general manager, Blackburn Corporation Tramways, was warmly commended by Councillor C. Higham, vice-chairman of the Tramways Committee, in referring, at the Council's May meeting, to the working of the undertaking during the past year. Nowhere in the country, said the vice-chairman, were the cars and their upkeep better looked after, and the time was not far distant when the undertaking would stand free from debt.

Potteries Electric Traction Staff. In the course of his remarks at the annual meeting of the Potteries Electric Traction Company, the chairman said he must refer to the excellent work which had been done under very trying circumstances by the general manager, Mr. W. Thom; the assistant manager, Mr. F. Hatch; Mr. Edwards, and the other officers. Mr. Thom had had thrown on his shoulders the work of arranging for the release of as many men as possible, and the work he had done had been fully recognised by the local recruiting authorities. On behalf of the shareholders he expressed their thanks to the officers for their good work. A reference to the distinctions gained on active service by Major Chapple, the power and rolling stock superintendent, appears under the heading, "With the Forces."

Sir Robert Hadfield, as chairman of the Standing Committee on Metallurgy, appointed by the Advisory Council for Scientific Research, at the opening meeting, called attention to the need in research and to the particular necessity for improvement and progress in metallurgy of iron and steel. Great Britain had been far from backward in this field, but there was room for a great extension of research, in which there would be a happy combination of science and practice. Further progress of metallurgy depended largely on securing the supplies of the special alloys and materials required, and there was now need for a central clearing-house, in order that as soon as new knowledge was secured as to valuable products in any part of the Empire it should be made available for British industry. No foreign control should be permitted.

Mr. I. Bulfin, general manager, Bournemouth Corporation Tramways, and his staff were complimented at the May meeting of the Council upon the results of the last year's working. Upon the recommendation of the Tramways Committee, Councillor Bell, chairman, moved "That the Council express to the general manager their appreciation of the position of affairs as shown by the report, which the committee consider, having regard to the exceptional circumstances of the year under review, is a matter for congratulation of both the manager and the entire staff." On the motion of the Mayor it was decided that the minute should be embodied in a letter to Mr. Bulfin. His Worship added that a good manager, a good chairman, and a loyal committee all deserved their meed of praise. In the report Mr. Bulfin referred to the loyalty of the staff in doing extra work.

Alderman F. Arnold, who died at Great Yarmouth on May 12, was for several years chairman of the Tramways Committee. Mr. Arnold was the foremost advocate of the introduction of the tramways to the town, and he displayed great interest in the work of the committee and the welfare of the employees.

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WITH THE FORCES.

Mr. E. J. Smith, the agent of the London and South Western Railway in Paris, has been granted a commission in the Royal Flying Corps.

Mr. L. C. F. Bellamy, manager and electrical engineer, Ilkeston Corporation Tramways, is still on active service at the front as a lieutenant in the Royal Engineers.

Mr. E. Bignell has resumed duty as installation superintendent at Sutton with the South Metropolitan Tramways and Lighting Company on being invalided from the army.

Mr. G. G. Hazard, London representative of Siemens Brothers' Dynamo Works, Limited, Upper Thames Street, E.C., has been appointed to the motor transport of the Army Service Corps.

Lieutenant Mulliner, assistant borough electrical engineer, Eccles, has been invalided from France owing to nervous breakdown. After a sojourn in hospital at Hampstead, he has gone to his home at Malvern.

Mr. C. W. Salt, borough electrical engineer of Torquay, who enlisted in the London electrical unit of the Royal Engineers and was recently given a commission therein, has been congratulated on his promotion by the Torquay Corporation.

Lieutenant Ben Fry, who for about three years prior to the war was purchasing agent for the Buenos Aires Lacroze Tramways and the Buenos Aires Central Railway, has been for the past sixteen months serving in the Army Ordnance Department. He was first posted to Tidworth, and then obtained a transfer to Devonport, where he remained until February last, when he received instructions to proceed to Liverpool. Lieut. Fry's new appointment is affording him an excellent opportunity of seeing the practical working of the railway at the port.

Major N. C. Pilcher, Canadian Mounted Rifles, brother of Mr. R. S. Pilcher, manager of Aberdeen Corporation Tramways, was killed in action on May 26. Major Pilcher came over with the Canadian Expeditionary Force nearly a year ago. He was through the whole of the South African campaign, and had been connected with the Canadian Militia for many years. In civil life he was general manager of the Sherbrook Electric and Street Railway Company, Sherbrook, Province of Quebec, Canada. He leaves a wife and one child.

Major F. J. Chapple, power and rolling stock superintendent, Potteries Electric Traction Company, who is serving at the front with the North Midland Heavy Battery, was referred to by Mr. R. J. Howley, the chairman of the company, at the annual meeting. The shareholders, he said, would be glad to hear that Major Chapple, as he now is, had been mentioned in despatches and had been made a Companion of the Distinguished Service Order for the good work which he had done since February last. He was sure that the thoughts of the shareholders went out to Major Chapple and to the other members of the staff who were serving their country, and that they wished them all good luck and a safe return.

Captain R. J. Smith, of the Lancashire Fusiliers, who was killed on May 5, after graduating at Dublin University, went to Manchester to take up a position in the electrical department of the British Westinghouse Company in Trafford Park.

RAILWAY OFFICERS AND STAFF.

Mr. A. L. Charles, J.P., has retired from the secretaryship of the Midland Railway Company.

Mr. A. Scholefield, of Lint Close, Alnmouth, Northumberland, has been elected a director of the North Eastern Railway Company in place of the late Viscount Ridley.

Mr. Ralph Cope, chief clerk, has been appointed principal assistant to the chief accountant of the Great Western Railway. He entered the company's employ as a clerk in 1877.

Sir Charles Bine Renshaw, chairman of the Caledonian Railway, has been appointed by the Treasury chairman of the Committee for the Organisation of War Savings in Scotland.

Mr. E. Wells has resigned the position of chief joint accountant of the Great Western Railway, to which he was appointed in 1913. In 1902 and 1913 he visited Brazil as a member of a city firm of accountants, and reorganised the accounts of several railways.

Mr. A. W. Lyon, senior partner of the firm of Price, Waterhouse and Company, has been appointed by the Board of Trade to succeed to the position of consulting accountant to the Government, in connection with the control of the railways, rendered vacant by the death of Mr. J. Gurney Fowler.

Sir Charles Rivers Wilson, Finance Minister in Egypt 1878-79, British representative on the Suez Canal Board 1876-95, former president of the Grand Trunk Railway, and chairman of the British Electric Traction Company, who died on February 9 last, aged 84, left unsettled estate £10,091 gross and £8,528 net.

Mr. W. W. H. Warneford, on relinquishing the post of manager of the Crewe works of the London and North Western Railway, has been presented with an illuminated address and a case of cutlery from 4,800 employees and munition girls. To Mrs. Warneford a diamond ring was given. Mr. Warneford, who has been appointed superintendent at Earlestown, entered the works thirty-three years ago, and he was only 22 years of age when he became assistant manager of the steel works.

Sir Gilbert Claughton, chairman of the London and North Western Railway, voiced a stirring welcome at a luncheon at the Euston Station Hotel on May 16 to the employees of the company who formed the crew of the company's steamer "Tara," which was torpedoed in the Mediterranean. The survivors were landed on the North African coast, and fell into the hands of the Senussi. They were rescued by a motor car column commanded by the Duke of Westminster. The "Tara" was in the employ of the Admiralty.

Mr. J. J. Hill, the railway magnate, died at St. Paul, Minnesota, on May 29, after an operation. He had amassed a great fortune by railway construction and operation, and in face of the competition of the Northern Pacific and the Canadian Pacific, he succeeded in extending the St. Paul, Minneapolis and Manitoba Railway across three thousand miles until it became the Great Northern. His latest scheme was to rebuild the railways of Belgium.

CONDITIONAL EXEMPTION OF EMPLOYEES.

Mr. E. Hatton, general manager, Newcastle Corporation Tramways, appeared before the Newcastle Military Tribunal on May 9, with regard to tramway employees. He said they had a number of married conductors who were being trained as motormen. Out of 823 employees, 133 were eligible for service. There were 30 single motormen whom he must keep, and there were 100 married men who had received conditional exemption. The conductors were being trained as motormen, and in all there were 107 of such men for whom he wanted exemption. Lads were driving and earning 40s. per week, with overtime. In reply to the chairman, Mr. Hatton said that if the Government would release soldiers who were no longer needed, he would be glad to release some Corporation employees. But the Government would not listen to it. There was an increasing difficulty in getting women. The chairman suggested that an application be made to the Ministry of Munitions to secure released men so that further tramway employees might be released. It was agreed that the motormen be given conditional exemption, and a similar course was adopted with respect to 32 single conductors who were being trained as motormen and 75 married conductors. It was also decided that all up to and including group seven (men under 25 years) should be refused exemption. With regard to the inspectors, it was decided that all up to and including group 40 be refused exemption, and all labourers at the power station were similarly treated.

The Middlesbrough, Stockton, and Thornaby Tramways Company made application to Stockton Military Tribunal for the exemption of 16 drivers. The company had released 115 men and made provision for their dependants. They were now down to the limit of their staff, and for every three men taken away it would mean the withdrawing of one car from the service. In answer to the chairman, the manager said he had not introduced girls because he had been able to obtain plenty of youths under military age as conductors. It would not ease the situation to discharge these lads and take on their sisters. The tribunal thought the company should be able to make arrangements to spare a few more men, and seven of the applications were dismissed and nine granted conditional exemption.

At Wallasey, Colonel R. R. Greene, the tramways manager, asked for the exemption of twenty-six motormen. The military representative asked for some of the men, even if it involved inconvenience. Colonel Greene replied that they were ten men short for the present inadequate service. If more men were taken the service would have to be reduced. The traffic was greater than last year. If he found it possible to spare another man he would do so. Exemption was granted so long as the men remained in their present occupations.

Chicago Transit Problem.—Messrs. W. B. Parsons, R. Ridgeway, and B. J. Arnold have been appointed traction commissioners to investigate Chicago's transportation problem, with a view to determine on a plan for consolidated operation of elevated, surface, and, possibly, subway systems. Mr. H. M. Brinckerhoff has been appointed chief engineer to the Commission. During the past ten years he has reported upon many of the operating conditions of the largest companies in the States, and has visited and studied the traction undertakings of Europe.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.

TRAILER CAR EXPERIMENTS.

Besides taking advantage of the information available on the running of trailer cars in London, the Birmingham tramways department are making a thorough test from three points of view in the trailer car experiment in that city. It is being undertaken to show whether trailers are feasible having regard to the peculiar conditions of the city, what the effect will be on the general traffic in the thoroughfares, and whether the innovation is advisable from the point of economy. The experiment was entered upon owing to the shortage of cars and labour. In order to meet the requirements of the Board of Trade, the motor car and trailer have been fitted with a special coupling and brakes. At a trial inspection on May 15, a single-deck trailer was coupled to a double-deck car, and was run over two or three routes under the direction of Mr. Alfred Baker, the general manager.

BLACKBURN.

MAINTENANCE DURING SHORTAGE OF MATERIALS.

Mr. J. H. Cowell, general manager Blackburn Corporation Tramways, states that general repairs and maintenance were well attended to during the past year, and the cars were in a high state of efficiency. Four miles of trolley wire had been renewed, another portion should be renewed during next year, but as the wire could not be purchased at the present time, he had had this portion anchored so that there would be less danger of accident in case of breakage. By this means the Committee would be able to defer renewal to another year. Owing to the difficulty of obtaining rails, he had had renewed the really dangerous sections of the permanent way, so that the portions held over for renewing occur on the straight and not on inclines or curves.

BRADFORD.

FREE RIDING IN 1915–16.—ECONOMY IN RUNNING.

During the year ended March 31, 443,230 free tickets were issued to soldiers, Belgians, and visitors attached to the Lord Mayor's Relief Fund. The aggregate value of these tickets, estimated at 1½d. each, amounted to £2,770. The tickets were issued to the various classes of free riders in the following proportions: Soldiers, 333,400, of the value (on the basis of 1½d. per ticket) of £2,084; Belgians, 97,180, of the value of £607; Lord Mayor's Relief Fund visitors, 12,650, of the value of £79. In order to induce passengers to assist in the economical running of the cars they have been asked by the *Observer* of that city to give timely notice to the conductor when they wish to enter or alight. The writer states that the cost of electricity required to run a car for an hour is about 1s. 2d. or 1s. 3d., and the total cost of electricity for the tramways is about £50,000 a year. Some years ago there was a difference between the cost of running involved by particular drivers and others of from 33 to 40 per cent. As the result of care bestowed on their training most of the drivers are now within 5 per cent. of each other.

DUBLIN.

RESUMPTION OF TRAMWAYS TRAFFIC.

The military authorities allowed the full tramway service to be resumed in Dublin on May 15. The last cars started 15 minutes earlier than was the case before the revolt. Some of the services were restarted during the preceding week, but when passing the military cordons the cars were stopped for a cursory inspection of the passengers. Mr. D. M'Dowall Grosart, secretary and manager Dublin and Lucan Electric Railway, has related that when the rebels took possession of the South Dublin Workhouse on Easter Tuesday, sniping was continuous. The roar of machine guns and rifles became continuous, and the bullets passed over the company's buildings in hundreds. Soldiers were accommodated on the premises of the company, who supplied them with food. The company's service was maintained throughout.

DUNDEE.

WHY THE CITY HAS NO WOMEN CONDUCTORS.—RESTRICTION OF FREE RIDING.

According to Mr. Peter Fisher, the general manager of the tramways department, women have been brought to Dundee from four other towns to be trained to work at local factories; thus it would appear that there is a shortage at Dundee. On the other hand, there is a plentiful supply of discharged soldiers, and these men are being employed as conductors. Mr. Fisher pleads for a more sympathetic attitude from the public towards these men, who are often put upon the cars after three days' training. The Tramways Committee have restricted free passes to totally blind persons, nurses on war work, ordinary nurses, and probation officers.

GLASGOW.

84 WOMEN DRIVERS, 500 CLEANERS, 1,200 CONDUCTORS, AND MANY SWITCHBOARD ATTENDANTS.—TRAFFIC INTERRUPTION BY PROCESSIONS.—EXCURSION CARS.

On May 11, the date of the publication in *The Tramway and Railway World* of the photograph of a group of women tramcar drivers, their numbers totalled 68. Two weeks later they numbered 84, and Mr. James Dalrymple, the general manager, states that they all acquired experience as conductors before being taught to drive a car. On May 20 there were 200 women engaged in car cleaning and 300 men. By the end of the month all the latter had been liberated for national service. There are now more than 1,200 women conductors, as against 400 men. Some weeks ago women were trained to take charge of the switchboards in the power stations, after undergoing a test of their educational attainments. In consequence of their success in that capacity, some of them have been placed in charge of sub-stations. Owing to the inconvenience to the public and interruption of traffic generally consequent upon the tramway traffic being held up by processions through the streets, the Tramways Committee have made representations to the Magistrates Committee to the effect that when sanctioning these processions the magistrates define the routes. Councillor Montgomery, chairman of the Tramways Committee, has announced that the department cannot grant special car facilities on Saturdays. The department are not building any new cars, the traffic is the largest on record, and in these circumstances all available cars are required for the ordinary traffic. Pleasure parties, however, can have the use of special cars on other days.

HULL.

EMPLOYEES' FIXED HOURS OF WORK.

Alderman Hargreaves, Lord Mayor of Hull, in retiring from the chair of the Tramways Committee on May 24, reviewed the work of the committee during his three years' chairmanship. The employees' hours of labour had been adjusted, he said, by a system that did not exist in any other city. The men began duty at a certain time and knew exactly the hour at which their day's work was ended. Volunteers had always been ready to come forward for overtime work. During the three years the cost of car maintenance had been reduced by £12,000. Halfpenny stages had produced gratifying results, the income having increased from 8½d. per car-mile to 9½d. At the end of the last financial year the department had a profit of £12,469, of which £10,000 went in relief of the rates, and £2,469 passed to the reserve fund, which now stood at £142,000. The committee were paying £4,078 annually in war bonus, and £8,759 per annum to men who had joined the forces. There was an increase in the coal bill of £1,997, and soldiers were carried for nothing. The population had been reduced in two years by enlistment from 291,118 to 269,530.

LONDON.

TRAILERS FOR THE M.E.T.—FOURTH TRAILER ROUTE ON THE L.C.C. TRAMWAYS.—PRAISE FOR TRAMWAYS MANAGEMENT—THE CLOSING OF RAILWAY STATIONS.

The application made by the Metropolitan Electric Tramways Company, Limited, for authority to run trailer cars has been sanctioned by the Board of Trade. The London County Council have adapted a depot at Evelyn Street, Deptford, for the housing of trailer cars, which are being run on the Greenwich and Woolwich section. This is the fourth route on which trailers are in service, greatly to the convenience of the travelling public, while other forms of traffic are in no way hindered. The National Association for the Extension of Workmen's Trains and Tramcars has written thanking the Council and the tramways management for their successful efforts to increase the early morning tramway services in order to carry the traffic displaced on the South Eastern and Chatham Railway by the closing of several stations in South London. Workpeople, the Association stated, much appreciated the additional accommodation provided on the tramways. In reference to the approaching closing of certain G.E.R. stations, the Highways Committee have reported that so far as the traffic was directed to Aldgate there would be no difficulty in accommodating the passengers, although the tramways were unable to offer to passengers to Liverpool Street a convenient and direct service equivalent to that afforded by the railway. It is estimated that 2,000 railway passengers will be displaced.

MANCHESTER.

REQUESTS FOR THROUGH RUNNING.—SAVING OF TIME BY RAILWAY ELECTRIFICATION.—A TRIBUTE TO WOMEN CONDUCTORS.

In order to meet the requirements of factory workers in the Reddish district, arrangements have been made with the Stockport Corporation Tramways for the temporary through running by Manchester Corporation cars. In response to an appeal made at a meeting of Oldham Town Council, Oldham Tramways Committee undertook to reconsider the question of through running to Manchester and to Rochdale. On the latter route it was stated that the double-deck cars could not pass underneath a railway bridge, and a member advocated that the height of the vehicles should be reduced. In connection with the opening of the electric train service between Manchester and Bury, a statement has been issued showing that by steam train the journey from Manchester to Bury, with stops, takes 32 minutes, as compared with 24 minutes on the electric service. From Bury to Manchester the time by steam train is 29 minutes, as against 22 minutes by electric train. Mr. J. M. McElroy, the general manager of the Corporation Tramways, has

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spoken in high terms of the manner in which the women conductors work. Fewer complaints are lodged proportionately than against the men. There is, however, a desire to assist them by the public. There had been comparatively little illness among them. Before being employed they are examined by Dr. Catharine Chisholm. This lady has approved of the summer uniform, the main change in which is a short jacket and a straw hat.

NEWCASTLE-ON-TYNE.

DOUBLE-DECK CAR WITH FRONT EXIT.—ENFORCING TRAMWAY BY-LAWS.

So successful has been the working of single-deck cars with front exits that the Corporation tramways department have completed designs for the alteration of double-deck cars to this principle of unloading. Mr. E. Hatton, the general manager, is to be congratulated upon the success that has attended his enterprise in adapting single-deck cars to front exit working, and at the same time increasing the accommodation of these vehicles. In our issue of April 13 we gave a full description of what has been accomplished in that direction, the article being illustrated by four photographs. With a view to discourage the practice of crowding on to full cars, the tramways department are instituting prosecutions.

SHEFFIELD.

PASSENGERS' OFFENCES.—RETURN OF SOLDIER EMPLOYEES.—CONVEYANCE OF SCHOOL CHILDREN.—WOMEN AS CLEANERS.

The great increase of traffic and the presence of women conductors recently led to an increase in offences against the tramway by-laws, but thanks to prosecutions instituted by the department, the tendency seems to have been repressed. Some of the credit for this result is due to the magistrates, whose scale of penalties was 20s. for persons who attempted to avoid payment of fares, 40s. for riding past a stage and threatening a woman conductor who asked for the excess fare, and 20s. for boarding a car when the accused was intoxicated. In cases where tramway employees return to work from war service, the general manager, in dealing with wages rates and merit pay to them, will count as corporation service the period they have served with the forces. The Tramways Committee have agreed to convey about 100 children to and from the Whiteley Wood open-air school during the season, at a cost to the Education Committee of £275. The Committee have authorised the general manager to employ women car cleaners on night work at the depots, at the same rate of pay as men, viz., 7d. per hour, plus 2s. war allowance per week. The women are to work 45 hours a week.

DEPRECIATION RATES AT GLASGOW.

Glasgow Corporation have adopted a recommendation by the Tramways Committee that in making up the annual accounts of the department depreciation for the current year shall be at the following rates :—

Permanent way	£350	per mile.
Electric equipment of line	Average 2·9	per cent.
Ground	—	,,
Buildings and fixtures	2½	,,
Power station and sub-stations plant ...	5	,,
Workshop tools and sundry plant ...	5	,,
Cars	Average 8·2	,,
Electric equipment of cars	6	,,
Other rolling stock... ...	Average 16·4	,,
Miscellaneous equipment	5	,,

Councillor Battersby unsuccessfully moved that the recommendation that depreciation be at the same rates as last year be remitted back for further consideration. He contended it was true that the Corporation secured some of the money devoted to the depreciation fund. Treasurer M'Millan, in seconding, said that in a time like this, when the common good had been depleted for the last two years, the tramways department, which was really part of the common good, should reconsider the depreciation rate.

The Economical Production of Steam.—A nicely illustrated pamphlet is issued by Messrs. Scholey and Company, of 56, Victoria Street, Westminster, on "The Economical Production of Steam." This, it is pointed out, is secured by the use of the Taylor mechanical stoker and the Copes feed water regulator. As to the former apparatus, it is claimed that it increases the capacity of the boiler, burns fuel efficiently, has low maintenance costs, and reduces operating expenses. The two fundamental features of operation are underfeed and automatic cleaning. The coal is moved along by rams, there being no moving grate bars. In regard to the Copes feed water regulator, its principle is that the expansion of a tube controls the feed valve. The apparatus is nothing more than a special metal tube inclined on a bracket. One end of the tube is connected to the steam space of the boiler and the other end to the water space. According as steam or water predominates in the tube, the latter expands or contracts, and this movement operates the valve. Messrs. Scholey will be happy to give to inquirers further information than that contained in the pamphlet.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

The following applications for Letters Patent were filed previous to May 28, 1916 :—

Electric locomotives (5,934)—British Thomson-Houston Company (*General Electric Company*).
Electric motor control systems (6,160)—British Thomson-Houston Company (*General Electric Company*).
Friction members of clutches and brakes (5,930)—T. Clarkson.
Clutch and brake-operating mechanism (5,935 and 5,936)—T. Clarkson.
Lifting-jacks (6,055)—L. E. Cowey.
Brake-slack adjusters for railway vehicles (5,871)—A. E. Hayward.
Points for tramways, railways, etc. (5,972)—R. B. Holt.
Motor vehicles (6,123)—R. F. Macfie.
Ticket delivery and checking apparatus (6,016)—A. Marsh.
High power and speed turbine plant (6,114)—Maschinenfabrik Oerlikon.
Automatic couplings for railway rolling stock (6,533)—P. T. Anslow.
Systems of control (6,292)—British Westinghouse Electric and Manufacturing Company.
Vibrating make-and-break devices for electric signalling (6,476)—A. C. Brown.
Air-brake apparatus (6,497)—California Valve and Air Brake Company.
Means for preventing side-slipping of road vehicles (6,366, 6,367, and 6,368)—F. H. Neate.
Electrically propelled vehicles (6,530)—C. J. Spencer.
Reversing controller for petrol-electric cars, etc. (6,249)—W. A. Stevens.
Vaporiser to burn paraffin oil as fuel for petrol engines (6,190)—F. Walker.
Electric motor control systems (6,639)—British Thomson-Houston Company (*General Electric Company*).
Form of transmission for motor vehicles (6,667)—J. W. Brown.
Power transmission for motor vehicles (6,729)—J. Casey.
Railway or tramway switch-operating mechanism (6,682)—A. Galston.
Power transmission for motor vehicles (6,729)—J. Henley.
Reversing mechanism for compound brakes (6,657)—W. Hildebrand.
Elevated railways (6,712)—W. Hinsen.
Resilient wheels for automobiles, traction cars, etc. (6,615)—A. Keay.
Reversing mechanism for compound brakes (6,657)—Knorr-Bremse-Akt.-Ges.
Automatic train-stopping mechanisms (6,814)—National Safety Appliance Company.
Air-brake systems (6,818)—National Safety Appliance Company.
Friction driving-gearing for motor vehicles (6,624)—J. T. Pickering.
Lubricating apparatus (6,845)—E. K. Wallace.
Lubricating apparatus (6,845)—J. L. Wallace.
Apparatus for protection of trains (7,137 and 7,138)—A. R. Angus.
Apparatus for controlling and stopping trains independently of drivers (6,989)—A. F. Bound.
Chassis construction on motor vehicles (6,905)—H. E. Buck.
Splash-guards for road vehicles (7,076)—G. Cheremisinoff.
Window cleaning devices for street cars (7,126)—H. J. Drake.
Wheel for road vehicles (7,044)—A. T. Eastman.
Combination brake and grinding shoe for vehicles with flanged wheels (7,082)—W. V. Edwards.
Metallic spring keys for railway chairs (7,142)—W. H. Flood.
Tramway systems (6,948)—P. Kenyon.
Railway vehicle controlling systems (7,040)—W. B. Murray.
Metallic spring keys for railway chairs (7,142)—C. Ross, Limited.
Apparatus for controlling and stopping trains independently of drivers (6,989)—W. Rowland.
Wheels for road vehicles (6,956)—R. Rutherford.
Tire or rim for wheels of road vehicles (6,968)—W. Spencer.
Combination brake and grinding shoe for vehicles with flanged wheels (7,082)—H. A. Stevens.
Sanding apparatus for locomotives (7,116)—G. H. Willans.
Spring mountings for vehicles (7,390)—Birmingham and Midland Counties Transport Company.
Means for joining railway rails (7,536)—T. M. Daniels.
Vehicle wheels (7,568)—Dunlop Rubber Company.
Life-saving guard for the front of mechanically-propelled vehicles (7,421)—W. M. Holdom.
Speed indicating apparatus (7,450)—E. Jaeger.
Vehicle wheels (7,568)—C. Macbeth.
Motor vehicles (7,519)—L. H. Pomeroy.
Motor vehicles (7,521)—A. R. Pullin.
Spring mountings for vehicles (7,390)—G. E. D. Ralls.

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Motor vehicles (7,519)—Vauxhall Motors, Limited.
Detachable and self-locking device for automobile bodies (7,493)—F. G. Wiles.

Specifications Published.

1915.

Resilient tires (6,651)—Price.
Steering mechanism for automobiles, etc. (7,060)—Besserdich.
Trailers for vehicles (7,086)—Delaney.
Spring return mechanism for electric motor controllers (9,706)—Electric and Ordnance Accessories Company, Langrish and Hodgson.

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Electrically-driven luggage truck (10,325)—Hamilton.
Means for preventing the skidding of motor cars and other mechanically-propelled road vehicles (10,457)—Morgan.
Air-brake systems (5,188)—Comerford and Hicks.
Rail joints (5,368)—Arboren.
Mud protector for use on motor vehicles (5,400)—Fairbrother (*J. B. Laggiard and Company*).
Vibrating make-and-break devices for use in electric signalling (7,840)—Brown.
Means for securing railway rails to sleepers (10,039)—Leyshon.
Tire-making machines (5,932)—Goodyear Tire and Rubber Company.
Electric signalling system for railways (6,542)—Mackenzie.
Change-speed driving gear (6,444)—Philipson, Philipson and Philipson.
Keys for securing rails in their supporting chairs (6,602)—Williamson.
Track ramps for signalling and train stopping apparatus (14,360)—Ballington and Shaw.
Wheels for road vehicles (14,364)—Oliver.
Electric signalling (3,520)—International Electric Company, Roose and Le Noir.
Resilient wheels (6,067)—Basjanoff.
Fire-boxes for locomotives, etc. (6,206)—Ducas.
Automatic signalling for tramways or electric railways (6,362)—Samaia.
Controlling mechanism for automobiles (6,469)—British Thomson-Houston Company (*General Electric Company*).
Change-speed gears (6,472)—Henroid-Schweizer.
Apparatus for cab signalling and for stopping trains independently of drivers (6,481)—Firth and Leake.
Railway signalling (6,601)—W. R. Sykes Interlocking Signal Company and Tarrant.
Rail joints (6,686)—Hill.
Vehicle wheels (8,036)—Madden.
Electrical installations, particularly applicable for use in motor vehicles (8,466)—Soc. Anon. des Etablissements L. Bleriot.
Means for cooling the engine of motor road vehicles (8,764)—Lucas.
Railway sleepers (8,916)—Livesey.
Friction brakes for motor cars (9,032)—Raffo.
Covers for pneumatic tires (12,380)—Taylor.

Thermit Rail Welding.—We understand that eight patents of Thermit, Limited, relating to rail welding have been suspended in favour of the British Thermit Company, Limited, Liverpool, to whom a licence is about to be granted under a royalty for the use of these patents in carrying out work themselves. This decision, we believe, in no wise affects the position of Thermit, Limited, who remain owners of the patents, and will be able to supply the material or carry out the work in the same way as hitherto.

Colonial and Foreign Tramways Traffic Returns.

NAME OF COMPANY.	1915. WEEKS ENDED					1916. WEEKS ENDED.					AGGREGATE.		
	May 1	May 8	May 15	May 22		April 29	May 6	May 13	May 20	Wks.	1916.	Increase or Decrease.
	£	£	£	£		£	£	£	£		£	£
Anglo-Argentine	50,995	54,791	53,137	53,193		52,781	54,938	54,974	52,485	21	1,028,646	+ 129
Auckland	20,216	(28 days)	20,447	(28 days)		20,767	(28 days)	21,202	(28 days)	44	231,906	+ 4,308
Burma... Rs.	3,707	3,488	3,496	3,827		3,641	3,732	3,911	3,859	42	—	+ 7,640
Calcutta Rs.	59,956	60,878	61,831	65,031		63,336	69,152	65,636	65,765	21	1,353,219	+ 83,634
Madras Rs.	...	(2 weeks)	29,228	...		...	(2 weeks)	29,191	...	22	310,815	+ 24,500

Companies Issuing Monthly Statements.

	1914.	1915.					1915.	1916.					Wks.	AGGREGATE.	
	Dec	Jan.	Feb.	March.	April.	May.	Dec.	Jan.	Feb.	March.	April.	May.		1915-16.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Brazilian Street Mlrs.	...	...	...	...	...	...	...	...	...	...	...	...			
Brazilian Traction Mlrs	6010490	5996190	5797500	6294910	6333460	...	6527000	6430000	6079000	6711000	6678000	...	18	25,898,000	+1,475,940
Brisbane ...	30,890	29,620	34,050	30,740	29,890	...	33,960	32,280	30,320	34,275	32,575	...	18	129,450	+ 12,610
British Columbia $	674,063	640,495	558,512	557,135	...	...	603,667	591,949	572,935	577,117	...	...	39	4,982,147	− 772,894
Buenos Aires Pt. & C.	...	...	...	...	...	...	...	...	...	...	...	...			
Buenos Ayres Lacroze	44,000	43,301	38,877	44,332	41,765	44,480	43,528	40,596	39,137	42,219	40,220	41,503	48	454,605	− 11,116
Cape Town ...	15,869	15,660	...	...	...	...	16,589	16,030	...	14,994	...	...			
Carthagena & Herrerias	1,255	904	1,822	2,436	1,496	1,931	2,129	2,841	1,585	2,991	2,513	2,927	22	12,857	+ 4,268
Cordoba ...	12,091	11,945	11,534	12,746	...	...	13,025	12,329	11,831	13,598	...	...	52	161,906	+ 6,251
East India ...	1,839	1,914	1,649	1,846	1,864	...	2,062	2,015	1,863	2,196	2,116	...	39	18,706	+ 1,466
Kalgoorlie ...	2,905	2,372	2,352	...	...	...	3,018	2,236	2,248	...	...	...	9	4,484	− 240
La Plata ...	4,452	4,540	4,016	4,582	...	...	4,564	4,533	4,346	4,613	...	...	13	13,492	+ 362
Lima	32,411	33,043	30,164	34,185	31,633	...	34,685	34,014	32,900	34,159	33,556	...	18	134,629	+ 5,614
Manaos ...	...	...	...	...	...	...	...	...	...	157,156	...	...			
Manila	$ 132,500	...	...	119,984	...	...	141,350	...	...	124,750	...	...			
Melbourne ...	...	62,729	59,086	...	...	...	72,658	69,879	69,395	...	...	...	9	139,274	+ 17,459
Mexico ... $	...	...	...	...	...	...	...	...	...	...	...	...			
Monte Video ...	28,605	32,459	30,008	29,716	26,786	...	31,305	34,252	32,502	31,956	28,997	...	26	187,419	+ 12,764
Fort Elizabeth ...	...	...	...	...	...	...	4,360	4,193	3,857	...	...	...			
Puebla ... $	...	...	...	...	...	...	...	...	...	...	...	...			
Rangoon ...	4,459	4,689	4,991	5,217	4,964	...	4,492	4,763	4,674	5,501	4,849	...	18	19,787	− 74
Toronto ... $	...	843,351	767,326	820,750	...	...	...	906,350	846,256	910,969	...	...	13	2,663,575	+ 232,148
Winnipeg ...	$ 368,400	350,681	314,658	303,209	..	..	377,121	297,560	293,250	296,500	...	...	13	887,310	81,239

(Continued on page 452)

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TRAFFIC RETURNS—*continued.*

Tramways and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1915. WEEKS ENDED.				1916. WEEKS ENDED				AGGREGATE.		
	May 1	May 8	May 15	May 22	April 29	May 6	May 13	May 20	Wks.	1916.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Aberdare	310	320	335	316	444	403	335	346	7	2.516	+ 177
Aberdeen Corporation	1.564	1.794	1.639	1.613	1.734	1.997	1.663	1.740	50	89.018	- 5.628
Accrington Corporation	531	542	519	728	553	549	556	613	8	4.566	+ 45
Ayr Corporation	308	292	340	333	442	317	299	326	½	256	- 77
Bath Electric	*	...	...	...	...	...	...	...	...	...	...
Birkenhead Corporation	1.326	1.315	1.327	1.368	1.569	1.420	1.433	1.516	7¼	10.644	+ 748
Birmingham Corporation	12.762	12.915	12.940	12.996	17.916	15.680	15.827	16.362	7	116.426	+ 20 386
Birmingham Corp. Motor Omnibuses	745	786	748	774	1.176	833	838	971	7	6.398	+ 823
Blackburn Corporation	1.172	1.188	1.252	1.240	1.953	1.328	1.166	1.166	7¼	9.543	+ 62
Blackpool and Fleetwood	393	439	369	416	1.249	620	419	478	20	8.246	+ 949
Blackpool Corporation	660	1.113	700	699	3.381	1.546	827	844	7	9.416	+ 2.507
Bolton Corporation	2.576	2.735	2.722	1.711	3.017	2.684	2.710	2.934	8	21.281	- 1.718
Bournemouth Corporation	1.988	2.011	1.861	2.684	2.394	2.055	2.075	2.264	8	17.372	- 160
Bradford Corporation	6,363	6,131	6.865	6,346	8.814	6.300	6.261	7.015	7	49.017	- 543
Brighton Corporation	971	999	984	1,067	1.431	1.066	982	1.191	7¾	8.117	+ 546
Bristol	9.038	9,357	9.087	9,912	11.233	9.822	9.306	9.958	20	186.884	- 10.264
Burnley Corporation	1,477	1,555	1.564	1.525	1.862	1.705	1.646	1.677	20	13.841	- 1.282
Burton-on-Trent Corporation	280	282	284	286	280	258	251	265	7	1.852	- 199
Bury Corporation	1.334	1.357	1.294	1.328	1.607	1.326	1.314	1.498	7¾	10.641	+ 330
Cardiff Corporation	2.556	2.631	2.625	...	3.264	2.860	2.764	...	...	...	...
Chatham and District	1.042	1.172	1.128	1.129	1.523	1.235	1.137	1.240	20	21.839	+ 1.211
Chesterfield Corporation	247	265	250	249	365	271	257	268	7	1.939	+ 134
Colne Corporation	232	241	241	251	314	...	259	279	...	...	...
Cork Electric	523	521	563	497	508	541	446	516	20	9.146	- 90
Croydon Corporation	1.726	...	...	...	1.403	...	...	...	4	5.417	- 666
Derby Corporation	959	1.001	1.021	1,046	1.273	1.048	1.084	1.156	7¼	8.052	+ 411
Dover Corporation	264	297	288	301	343	306	281	315	8	2.160	- 8
Dublin and Lucan	161	142	150	139	170	69	113	144	20	2.356	- 259
Dublin United	6.369	6.141	6.035	5.867	...	...	4.186	5.947	20	106.142	- 8.567
Dundee City	1.285	1.277	1.302	1.317	1.354	1.306	1.302	1.279	52	70.455	+ 3.902
East Ham Corporation	1,315	1.348	1.358	1,221	1.435	1.289	1.252	1.311	7¼	9.221	219
Exeter Corporation	356	366	363	354	465	371	346	375	7	2.593	- 16
Gearless Motor 'Buses	*	...	...	...	...	...	...	...	...	...	...
Glasgow Corporation	22.426	22.179	22.014	22.814	23.082	23.175	22.584	23.355	51	1.112.076	+ 78.070
Glasgow Subway	1.086	1.101	1.073	1.065	1.133	1.186	1.180	1.139	20	24.616	+ 2.783
Glossop (Urban Elec. Supply Co.)	119	137	124	126	154	138	136	140	21	2.765	+ 386
Halifax Corporation	1.957	2.067	2.105	2,083	3.159	2.280	1.932	2.072	6¼	14.772	+ 33
Halifax Corp. Motor Omnibuses	46	48	46	47	64	44	39	42	6¼	293	- 45
Hastings and District	872	902	902	864	1.552	1.026	865	974	20	16.236	+ 453
Huddersfield Corporation	2.480	2.560	2,542	2.525	4.216	2.687	2.744	2.896	7	20.694	+ 2 461
Hull Corporation	2.998	3.027	2.882	3,082	3 044	3.002	3.033	3.131	7	21.899	- 815
Ilford U.D. Council	610	641	633	632	832	693	643	691	7	4.944	+ 461
Ilkeston Corporation	121	126	125	124	125	125	132	144	8	1.057	+ 39
Ipswich Corporation	425	441	427	512	573	441	459	511	7	3.440	+ 280
Isle of Thanet	310	334	323	457	502	314	263	340	33	8.756	- 1.415
Kilmarnock Corporation	164	165	211	170	182	171	199	121	1	122	- 48
Lanarkshire	1.870	1.855	1,831	2.001	2.576	2.400	2.112	2.184	20	43.020	+ 7.103
Lancashire United	1.629	1.640	1,690	1,703	2.563	1.793	1.658	1.696	20	33.015	+ 1.806
Leeds City	8,401	8.525	8.593	8,736	11.833	9.160	9.100	9.772	8	69.365	+ 8.107
Leicester Corporation	2.939	3.097	3,014	*	3.842	3.259	3 263	...	19	61.860	+ 7.467
Leith Corporation	706	716	717	577	827	774	810	627	1	627	+ 50
Leyton U.D. Council	1,516	1,620	1,619	1,683	2.009	1.559	1.465	1.553	7	11.181	- 329
Liverpool Corporation	13,123	13,340	13.333	13,402	14.877	14.024	13.952	14.125	20¼	270.115	+ 13.823
Llandudno and Colwyn Bay	308	317	304	317	580	307	265	294	24½	5.450	- 226
London County Council	...	50,155	50.891	22,460	...	46.931	45.774	46,978	6¼	315.496	+ 9,369
London General Omnibus	*	...	...	...	...	...	...	...	...	...	...
London United	*	...	...	...	...	...	...	...	...	...	...
Lowestoft Corporation	154	156	152	160	144	141	118	132	32¼	4.231	- 1.220
Maidstone Corporation	178	205	198	197	257	219	187	206	7	1.562	- 10
Manchester Corporation	17,326	17,777	17,595	17,759	20.066	18 406	17.971	18.559	7	132.715	+ 7.628
Metropolitan Electric Tramways	*	...	...	...	...	...	...	...	...	...	...
National Steam Car	*	...	...	...	...	...	...	...	...	...	...
Nelson Corporation	184	170	183	180	273	194	187	208	7¼	1.601	+ 207
Newcastle-on-Tyne Corporation	5.944	6,019	6,092	6,322	6.136	5.980	6.158	6.488	7	44.031	+ 968
Newport (Mon.) Corporation	815	804	806	835	1.030	866	856	944	7	6 502	+ 1.317
New St. Helens and District	957	902	938	895	1.426	972	855	902	46	45.639	+ 3.341
Northampton Corporation	701	804	731	731	894	747	697	680	7	4.859	- 331
Nottingham Corporation	3,436	3.510	3,539	3,454	4.362	3.692	3.617	3.777	7	26.186	+ 1.070
Oldham Corporation	2.290	2.244	2 223	2.387	2.894	2.267	2.321	2.615	8	20.519	+ 1.236
Portsmouth Corporation	2.399	2.502	2,451	2,474	3.297	2.638	2.496	2.678	8	19.023	...
Preston Corporation	873	922	914	898	1.185	1.099	1.045	1.044	6½	7.113	+ 680
Provincial	2,077	2,193	2,152	2.182	2.816	2 244	2.163	2.397	33	69.706	+ 4.514
Reading Corporation	710	751	777	748	902	844	786	794	6½	5.530	+ 426
Rhondda Tramways	1.107	1.169	1,166	1.123	1.684	1.258	1.167	1,228	20	23 767	+ 1,354
Rochdale Corporation	1,594	1,697	1,620	1,682	2.025	1.647	1 658	1.747	7¼	13.161	+ 574
Rotherham Corporation	1.044	1.023	1,056	1.483	1.352	1.292	1.360	1.434	7½	10.782	- 2.203
Salford Corporation	4,996	5.108	4,998	5.510	5.680	5.144	5.206	5.758	7½	40.261	- 2.575
Sheffield Corporation	8.494	8.449	8.437	8,650	11.439	9.652	10.036	10.673	8	82.208	+ 14.251
Southampton Corporation	1.324	1,383	1,446	1,409	1.770	1.615	1.511	1.491	6½	10.289	+ 590
Southend-on-Sea Corporation	684	777	887	759	1.214	755	688	705	7	5.127	- 559
South Metropolitan Tramways	*	...	...	...	...	...	...	...	...	...	...
South Shields Corporation	720	723	735	769	892	728	735	805	7¼	5.624	+ 332
Sunderland Corporation	1.369	1,396	1,426	1,460	1.592	1.376	1.456	1.612	7	11.202	- 443
Sunderland District	591	574	546	559	889	527	494	541	29	16.532	+ 1 009
Swindon Corporation	173	197	195	192	255	201	188	189	6½	1.315	+ 53
Torquay Tramways	559	530	581	472	862	626	518	560	20	9.298	+ 72
Tramways (M.E.T.) Omnibus Co.	*	...	...	...	...	...	...	...	...	...	...
Tyneside Tramways and Tramroads	562	570	582	613	675	514	507	546	20	10.130	- 428
Wallasey Corporation	1.177	1,212	1,164	1,220	1.658	1.282	1.207	1.301	7¼	9.359	+ 446
Walsall Corporation	678	704	705	717	1.090	754	774	813	21	15.952	+ 2.211
Walthamstow U.D. Council	806	874	861	842	1.370	1.026	891	1.067	7	7.489	+ 1.373
Warrington Corporation	420	438	443	444	525	474	477	473	7	3.335	+ 353
West Ham Corporation	2.966	3.186	3.244	2.932	3.691	3.190	3.106	3.191	6½	22.115	+ 934
Wigan Corporation	1.439	1.469	1.450	1.583	2.012	1.575	1.559	1.616	7	11.353	+ 612
Wolverhampton Corporation	1.080	1.037	1.020	1.580	1.160	1.138	1.159	1.241	8	9.393	+ 653
Yorkshire (West Riding)	1.534	1,646	1,452	1,583	2.410	1.779	1.803	1.736	21	34.851	+ 3.639

* TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.

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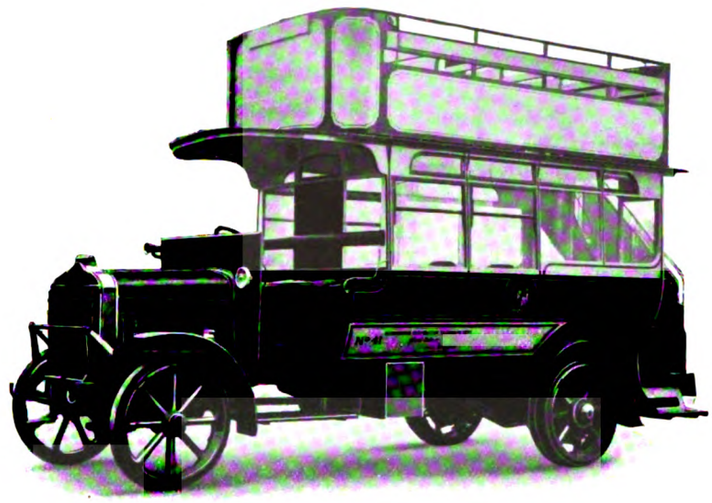

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14, NEW BURLINGTON STREET, LONDON, W.

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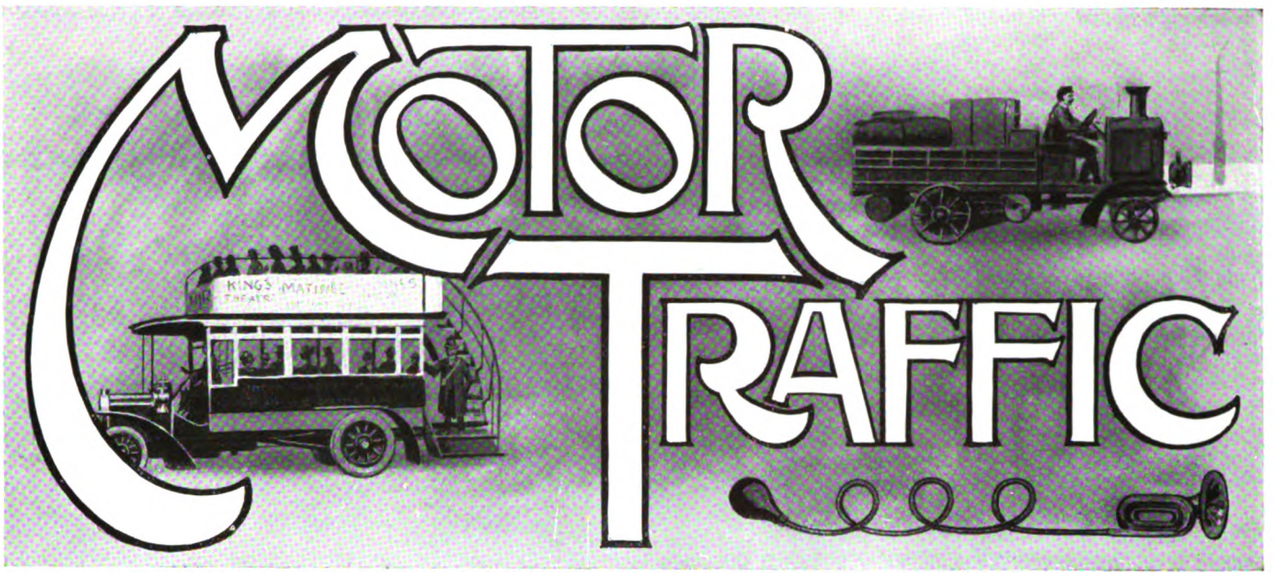

The relations of roads, road traffic, local authorities, and the State are more palpably in the melting-pot than they have been for a long time past, if, indeed, there has ever been any precedent for the present conditions. The machinery that existed before the war, having first been laid aside for a more or less indefinite period, is apparently now to be scrapped entirely, and there is no satisfactory indication available as to what there will be to put in its place. Possibly it is somewhat premature at present to speculate in this direction, but the events, both at home and abroad, of the past two years have given so much increased significance to the questions of roads and of the good control and maintenance thereof that curiosity on the subject is more than excusable. The hints dropped the other day by Mr. Hayes Fisher, Parliamentary Secretary to the Local Government Board, were hardly of a kind to inspire confidence in the future, so far as it may be dependent upon the wisdom and intentions of the Government. As to the abolition of the London Traffic Branch of the Board of Trade, little need be said. In the collection of statistics, and the formulation of standards, such, for instance, as that of "obstructive factors," it did extremely good work. Its usefulness, however, was severely limited by its purely advisory and recording capacity. It could only gather facts together, and make recommendations based thereon; and although its facts and its recommendations alike were unanswerable, nothing was and nothing could be done by it. If there were any promise in the suggestions outlined by Mr. Hayes Fisher that relative shams of this description were after the war to be succeeded by really comprehensive practical organisations, one would have welcomed them. Such, however, does not appear to be the case.

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It is now proposed that the Road Board should finally disappear, its funds and functions being taken over by a branch of the Local Government Board, which also would undertake, presumably, the work hitherto performed by the Traffic Branch of the Board of Trade. It is further suggested, although less definitely, that the questions involving roads and traffic, which, in their varied aspects, now come within the purview of four separate Government departments, might with advantage be concentrated in one. For this there may be something to be said theoretically, but there are many practical difficulties in the way of placing work previously distributed amongst four sets of people in the hands of one of that four. It is a much easier plan, and, in the circumstances now being considered, a desirable one, to create an entirely new authority, in which possibly the Road Board, the Home Office, the Board of Trade, and the Local Government Board can be either embodied or represented, as the case may be. It is inevitable that all the four departments must touch the main question of roads and traffic from their different angles; and such being the case, the argument for an entirely new authority is exceedingly powerful. It is, moreover, very necessary that the problems involved should be dealt with in the broadest possible way, unhampered by precedent or prejudice, and there can be no assurance in this sense if the work is to be done by any existing authority. There is, too, the question of the disposition of the funds of the Road Board, to which special conditions have always attached, subject only to suspension for the duration of the war. The administration of those funds cannot fairly be revised without reference to certain interests and certain arrangements made when the petrol and licence duties were first instituted. It will thus be seen that the balance of argument is very largely on the side of relegating any *ad hoc* consideration of these problems of roads and traffics to a separate and specially qualified body, and it would be difficult, if not impossible, to set up such an authority within any one Government department.

Those whose business it is to buy vehicles for Corporations, District and County Councils, and like authorities, are naturally becoming somewhat exercised in mind in regard to the clearly increasing difficulties in connection with fuel supplies. It is true that there is no visible likelihood that there will be any restriction whatever as regards the requirements of vehicles engaged on vital public services, but, obviously, the question of comparative cost is of the greatest importance, especially now, when municipal authorities are buying motor vans and motor appliances because of the war, with its widespread effects upon labour and on the supply of horses. That the needs of public health and similar work would come immediately next to those of the Army and Navy does, no doubt, relieve those concerned of a very large measure of anxiety. It cannot, however, and it should not, prevent the most serious consideration of this problem in its various aspects as they affect vehicles of the class referred to In the first place, it must be remembered

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that the obligation of economy in these matters rests upon all owners alike, whether they happen to be public authorities or private individuals, and the necessities of such authorities may in the last resort determine what proportion of their normal requirements of fuel ordinary users are to be allowed. The probability, therefore, though it amount to certainty, that whatever may happen there will be enough for street cleansing, fire-engine, and hospital purposes does not entitle Corporation and Council officials to regard themselves with any degree of detachment in these matters. Their ordinary duty demands that, whether on these "vital" services or any others, not a drop of spirit or an ounce of coal shall be unnecessarily consumed, which means in turn that there shall be no waste mileage of the vehicles. It is not suggested that there is anything approaching conscious or deliberate waste, but it would be impossible to assert that there is no waste at all, and it is more than probable that investigation on the right lines would show that in most places further reductions in fuel consumption and mileage are yet possible—in spite of efforts in that direction already made.

* * * * * *

Many users, however, who have not felt called upon to consider this matter in relation to vehicles already in service are experiencing some difficulty and hesitation in regard to new purchases, and in consequence the relative attractions of petrol, steam, and electricity as motive power are being discussed in borough and county departments with more vigour and detail than ever. So far as practical certainty of supplies are concerned, it may be affirmed that there is little or nothing to choose as between the three systems; any reasons that there might appear to be either for preference or otherwise are mainly theoretical. Thus it is, to all intents and purposes, a question of cost alone. At the present time, it must be said, there is much in the petrol situation that is calculated to give would-be consumers most serious cause for thought. It must be borne in mind, however, that present prices and circumstances are temporary, and while coal in general has not climbed to such an extent as spirit, there are reasons for believing that its after-war price will be appreciably nearer to that now ruling than will be the case with the latter product. On the face of it, therefore, there is no reason at present, and there probably never will be, for breaking up the homogeneity of now existent fleets of petrol vehicles by introducing steam for no other reason than fears as to petrol supplies. Still less are there present reasons for deserting steam in favour of electrics, inasmuch as the price of energy cannot remain indefinitely uninfluenced by the price of coal. In other words, the choice of the power agent in municipal transport must be decided on the same considerations as those which influenced policy in normal times.

How Motor Transport Assisted to Save Paris.—By the death of General Gallieni on May 27 is recalled the brilliant work by which he assisted to save the French capital from the advancing Germans in September, 1914. As military governor of the city, he organised a field army, which was moved out of Paris by means of motor cabs, omnibuses, and every type of self-propelled vehicle. This force, under General Mannuowry, fell on a flank of von Kluck's army, and the result was felt at the battle of Ourcq, which was the turning point of the enemy's advance and his defeat at the Marne.

RAILLESS TROLLEY AND BATTERY VEHICLE.

A Combination of Promise for Goods Carriage.

In these days, when trackless trolley omnibuses and storage battery vehicles are commonplaces, it seems quite natural, once the thing has been done, that we should have a combination vehicle capable of running by power from tramway overhead wires where the latter are available, and also of being driven by energy from a storage battery carried on board when it is desirable to work the vehicle along routes where there are no tramways. The thing has now been done, and the credit for it belongs to Mr. C. J. Spencer, general manager of Bradford City Tramways. This first application of the idea is to a goods wagon, but there seems to be no particular reason why the principle, with certain modifications, should not be extended to electric omnibuses when the local circumstances render such a combination advantageous. Apart from any possible development for passenger service, it has already been made obvious that for the carriage of goods over routes partly occupied by tramways and partly without such facilities a wide field of usefulness should be open for wagons of this type. To take a concrete example, a factory may be situated half a mile or a mile away from the nearest tramway route in a town. It has to send to and to receive from a railway station two or three miles away quantities of goods and material. The railway station in its turn may be some little distance from a tramway route. The plan of conveyance with such a vehicle available as the Bradford wagon is quite simple. The vehicle loads up its goods at the factory, and runs by battery power to the nearest tramway. There the battery is cut off, the trolley is raised and put on the wire, and the wagon proceeds to the point on the tramways nearest to the station. Then the trolley is pulled down, the battery is turned on, and the wagon proceeds into the railway goods shed or yard, where its contents are transferred to the charge of the railway company. Material coming from the railway to the factory can be dealt with in a similar way.

A trial was given to Mr. Spencer's wagon on May 8, when it was found to work with smoothness and efficiency in every respect. The new vehicle is quite simple in design, but wonderfully adaptive to the purposes to which it is to be put. Taking the chassis of an old trackless trolley car, Mr. Spencer has built upon it a long, broad lorry (shown in our illustration), similar in shape and dimensions to the motor lorries which have become so familiar in recent times. One great difference is that it does not use petrol, which is so dear in these days. It thus has the advantage of reducing the demand for the precious petrol, minimising running costs, and at the same time contributing greatly to the public convenience at a time when there is so serious a deficiency in transport services.

The chairman of the Bradford Tramways Committee (Mr. Enoch Priestley) and several other interested persons witnessed the test of the vehicle. At the Thornbury tramway depot it was seen wheeling in and out with the facility practically of an ordinary motor car. A load of two tons was put on the wagon, and with this it made a satisfactory journey to Wibsey.

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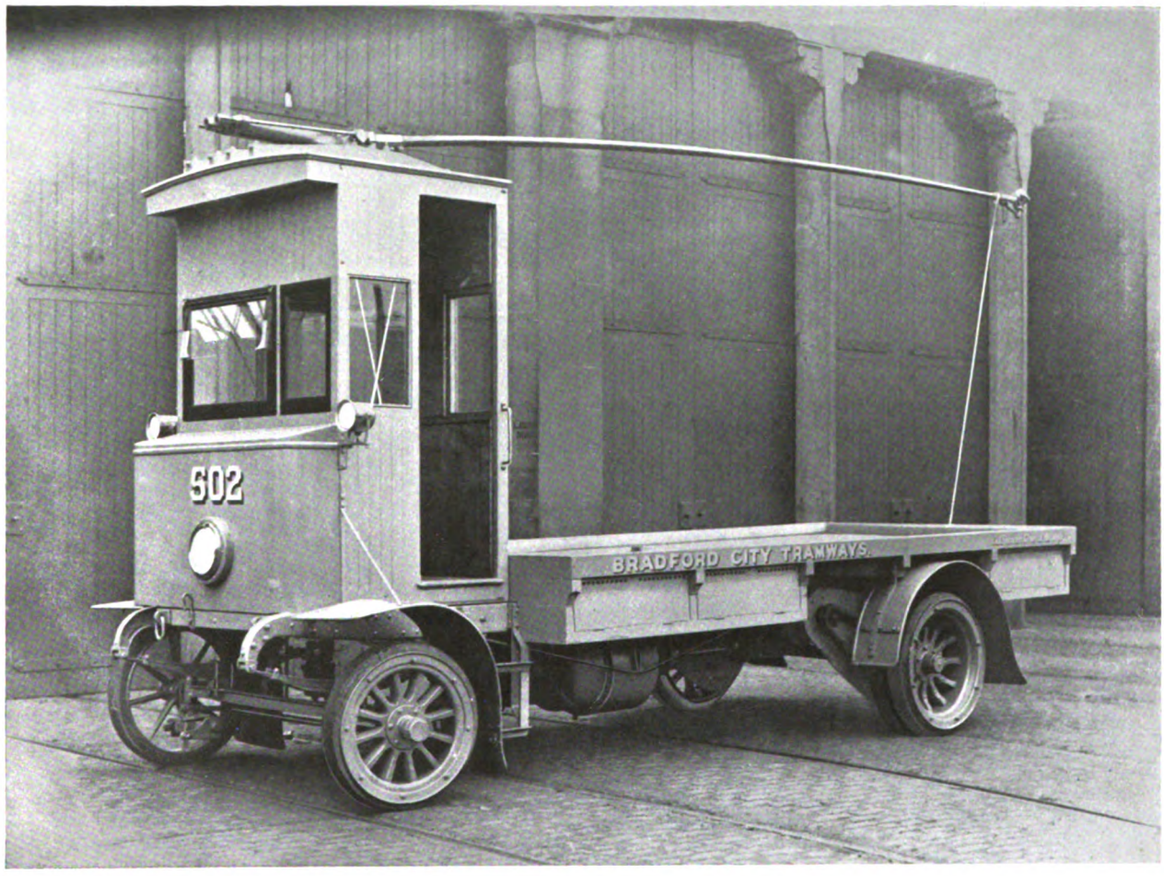
In recent times, of course, a great advance has been made in the adaptability of electric accumulators, enabling them to stand heavy rates of discharge for short periods and, on the other hand, to be charged very rapidly. This has enabled the new combined system of traction to be adopted. The wagon, as will be seen, is surmounted by a trolley pole to enable attachment to be made to the overhead wire, and earth attachment can be effected at will. Thus the wagon can be coupled up instantly with the tramway equipment and run at similar speeds, on the level or on rising gradients, as the passenger cars. When necessary, detachment can also be made instantaneously and the vehicle can be run short distances, up to a few miles, without any aid from the trolley wire.



Bradford Tramways Department's Railless Trolley and Battery Lorry.

To come to details, the equipment of the chassis is identical with that of the ordinary railless trolley chassis as used on the Bradford tramways; that is to say, two 20-H.P. motors with ordinary series-parallel control. It can therefore operate on a 500-volt circuit. The earthing device (for use when running on the trolley) is an extension of the steering arm of the vehicle bearing on the track by the medium of a cast-iron block and at the same time automatically steering the vehicle. This device, which has been used with considerable success for some time in connection with the Bradford ordinary trackless trolley cars when taking them over the tramway routes to the depot, was designed by the general manager of the Rotherham tramways, Mr. E. Cross.

The accumulators employed are of the Edison type (120 cells), giving a normal voltage of 150. They supply current to the ordinary 500-volt motors, the only difference being that the motor with battery supply runs correspondingly slower, that is, *pro rata* to the voltage, but as the torque of a series motor is proportional to the current passing through the windings, the vehicle is capable of climbing steep gradients but at a speed corresponding to the low voltage.

Whilst the vehicle is running on the 500-volt circuit the batteries may be in series with the motors, thus charging them whilst the car is in trolley service. The battery is capable of running the vehicle about 10 miles. The change-over from battery to overhead wire is merely a question of throwing over a switch, the putting of the trolley on the wire, and the earth connector on to the steering gear.

It is obvious that, if the use of vehicles of this kind extends, a demand may arise for full speed when running on the battery. This, of course, would mean the use of motors designed to give the speed with the comparatively low pressure obtainable from the battery. To enable such motors to work at a similar speed when the 500-volt current from the trolley wire was being used, it would probably be necessary to carry a small machine of the nature of a motor-generator to reduce the trolley wire voltage. That, however, is a matter for the future.

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ELECTRIC WAGON WORKING COSTS.

REPORT BY SHEFFIELD CLEANSING DEPARTMENT.

Mr. J. A. Priestley, superintendent of the Cleansing Department and Public Baths, Sheffield, has presented to the Cleansing Sub-Committee the following report on the working of the Edison electric battery tipping wagons owned by the department : —

The use of the electric battery vehicle for refuse collection in the city having now had some months' trial, I submit for your information the following particulars of the work done and the cost incurred, as compared with horse labour. The first vehicle was delivered in September last, and has been in regular work on day and night service for 21-22 weeks. The second vehicle was delivered in January, and has been similarly engaged for six weeks. The third vehicle, now on order, I am expecting to be delivered in the course of a few weeks. On day service the vehicles are engaged in the collection of bin refuse, and each employs one driver and three fillers, the former assisting also in loading where practicable. On night service ashpit refuse is collected, and each vehicle employs one driver and one filler, both men assisting in loading, the refuse in this case being shovelled into the vehicles from heaps previously wheeled out. Drivers are paid 33s. per week and fillers 30s. per week, with a war allowance of 5s. per week per man. Each vehicle is constructed to carry two tons. No. 1 vehicle was put to work on long distance journeys, and is principally employed on the High and Low Wincobank districts, the refuse being delivered at Lumley Street destructor. It has replaced three horses on each shift, but as two-thirds of the High Wincobank refuse was previously tipped at Wincobank, the extra distance covered by the vehicle is considerable, and could not have been done by the number of horses previously employed, and this fact should be borne in mind when the relative costs come to be compared. No. 2 vehicle is employed on comparatively short journeys, upon which horse-drawn vehicles are usually assumed to possess an unquestioned advantage. It has replaced two horses on day shift and three on night shift, the tipping being the same for both electric and horse wagons.

Although I propose to take the mean cost per ton for the two vehicles in comparison with the average cost over the whole city for horse labour, this is not strictly fair to the electrics, as the mean of the combined mileage is considerably greater than the average for the remaining districts of the city.

In arriving at the working costs of the electrics, I have included wages, vehicle costs, electricity, and tires. The first I have already given. The second comprises (1) capital costs, (2) insurance, (3) repairs, renewals, and maintenance, and (4) cleaning ; and is, so far as the first and third items are concerned, an estimate only, as there is no experience available in this country on these points. As regards No. 1, however, the cost of the battery represents one-half the total cost of the vehicle, and as this is guaranteed to give 100 per cent. of efficiency after a mileage representing about eight years' constant running on night and day service, it is reasonable to suppose that the writing off of the entire cost of the vehicle in ten years is an under estimate rather than an over estimate of its working life ; and for the same reason the estimate for item (3) representing practically 10 per cent. on the cost of the vehicle, exclusive of the battery, is a very liberal allowance considering the small number of working parts and the provision made elsewhere for tire renewals.

The consumption of electricity averages a fraction above 1½ units per mile (1·55), which is quite reasonable considering the hilly character of the city and the heavy nature of many of the undedicated roads traversed in collecting. A charge of 1d. per unit is made against the vehicles for current used, but this does not represent an actual expenditure, as the electricity is obtained from the destructor installation and the refuse consequently produces power for its own collection. The tires are guaranteed for 10,000 miles, and the renewals are amply provided for by an allowance of 1d. per mile. The details of the working costs are therefore as under : —

	£	s.	d.
Wages (actual amounts paid).			
Vehicle costs (p.c. £1,000) :—			
Interest and repayment of loan—10 years	123	5	10
Insurance	8	10	0
Repairs, renewals, and maintenance ...	50	0	0
Cleaning	8	4	8
	190	0	6

Electricity ... 1d. per unit.
Tires ... ... 1d. per mile.

Vehicle costs I have divided equally between the day and night work, and the other charges according to the wages paid, current consumed, and miles travelled on each class of work. For horse labour I have taken the current price paid to the Team Owners' Association for hired team labour. The results work out as follow :—

No. 1 VEHICLE. DAY WORK COSTS FOR 22 WEEKS.

Refuse collected ... ... 858 tons 6 cwt. 1 qr.

	£	s.	d.
Wages	154	15	8
Vehicle costs	40	7	1
Electricity 3,269 units	13	12	5
Tires 2,168 miles	9	0	8
	£217	15	10

Cost per ton, 5s. 0·8d.

COST OF ONE MONTH'S WORK ON SAME DISTRICTS WITH HORSE LABOUR.
Refuse collected, 167 tons 19 cwt. 2 qrs. Cost, £59 1s. 9d.
Cost per ton, 7s. 0·4d.

No. 1 VEHICLE. NIGHT WORK COSTS FOR 21 WEEKS.

Refuse removed ... ... 1,142 tons 19 cwt. 1 qr.

	£	s.	d.
Wages	72	3	8
Vehicle costs	38	10	5
Electricity—2,927 units	12	3	11
Tires 1,880 miles	7	16	8
	£130	14	8

Cost per ton, 2s. 3·4d.

COST OF THREE MONTHS' WORK ON SAME DISTRICTS WITH HORSE LABOUR.
Refuse removed, 473 tons 11 cwt. 2 qrs. Cost, £77 10s. 3d.
Cost per ton, 3s. 3·2d.

No. 2 VEHICLE. DAY WORK COSTS FOR SIX WEEKS.

Refuse collected ... ... 314 tons 4 cwt. 3 qrs.

	£	s.	d.
Wages	47	10	5
Vehicle costs	10	19	3
Electricity—670 units	2	15	10
Tires —417 miles	1	14	9
	£63	0	3

Cost per ton, 4s. 0·1d.

COST OF ONE MONTH'S WORK ON SAME DISTRICTS WITH HORSE LABOUR.
Refuse collected, 204 tons. Cost, £38 16s.
Cost per ton, 3s. 9·6d.

No. 2 VEHICLE. NIGHT WORK COSTS FOR SIX WEEKS.

Refuse removed ... ... 406 tons 13 cwt. 2 qrs.

	£	s.	d.
Wages	21	18	0
Vehicle costs	10	19	3
Electricity—758 units	3	3	2
Tires —459 miles	1	18	3
	£37	18	8

Cost per ton, 1s. 10·3d.

COST OF ONE MONTH'S WORK ON SAME DISTRICT WITH HORSE LABOUR.
Refuse removed, 440 tons 8 cwt. Cost, £55 10s. 2d.
Cost per ton, 2s. 6·2d.

The districts worked by this vehicle on day shift comprise the best in the city for horse labour, and from the results obtained I am led to the conclusion that for bin refuse collection in Sheffield horse labour holds an advantage where the total mileage per journey for the electrics does not exceed three miles, but beyond this distance, and at all distances on ashpit refuse, the electrics show a decided superiority.

Where electrics can only be used for day work the position differs somewhat, as the vehicle costs cannot be divided over two shifts, and the estimate of the working life of the vehicle under these circumstances will require careful consideration. In the collection of bin refuse also local conditions vary considerably ; the carrying distance differs in different districts, as also does the distance from bin to bin, and these factors have an important bearing on working costs.

So far as Sheffield is concerned, however, I am of opinion that with our system of day and night work, the electric vehicle is a pronounced success, and I recommend the extension of this method of collection as opportunity offers, particularly as it renders possible a scheme which can be realised in no other way, viz., the centralisation of the work of the department with one depot and one destructor at Lumley Street capable of dealing with the whole of the refuse of the city.

The appended tables of the cost of collecting refuse by the electric vehicles for the past six weeks, in comparison with the cost for the same period by horse labour, are interesting and conclusive :—

BIN REFUSE.

	Weight Collected.	Cost.	Cost per Ton.	Cost per Ton, including Chain Horses.
	T. c. q.	£ s. d.	s. d.	s. d.
ELECTRIC	561 0 2	124 11 1	4 5·3	—
HORSES :-				
Heeley Depot ...	2,090 15 3	489 0 10	4 8·1	4 9·9
Penistone Road ...	2,364 3 2	549 14 2	4 7·7	—
Worthing Road ...	2,458 0 2	600 3 0	4 10·6	5 0
All City	6,912 19 3	1,638 18 0	4 8·9	4 9·9

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ASHPIT REFUSE.

	Weight Collected.	Cost.	Cost per Ton.	Cost per Ton, including Chain Horses.
	T. c. q.	£ s. d.	s. d.	s. d.
ELECTRIC	777 12 1	76 16 8	1 11·7	—
HORSES:—				
Heeley Depot ...	1,400 4 1	210 14 7	3 0·1	3 3·5
Penistone Road ...	1,406 5 3	200 2 3	2 10·1	—
Worthing Road ...	870 14 1	109 0 11	2 6	2 9·7
All City	3,677 4 1	519 17 9	2 9·9	3 0·1

For all refuse combined the costs work out for electrics at 3s. 0·1d. per ton, and for horse labour at 3s. 9·2d. per ton, after making the necessary corrections in the latter case for the same proportionate ratio of bin to ashpit refuse as in the case of the electrics.

The following table is interesting as showing the average weight of refuse collected over the whole city per horse per day, in comparison with the work done by each electric:—

	Tons per Day per Horse.	Tons per Day per Electric.			Value in Horses.		
		No. 1.	No. 2.	Averge.	No. 1.	No. 2.	Averge.
Bin Refuse ...	3·39	7·05	8·73	7·90	2·08	2·57	2·33
Ashpit Refuse	3·94	10·30	11·29	10·80	2·61	2·86	2·74
Both	3·56	17·40	20·02	18·72	4·88	5·62	5·25

THE NEW TAXES.

The A.A. and M.U. have approached the Chancellor of the Exchequer and recommended:—(a) Reduction of the proposed increased tax on the 16-26 H.P. class of car; (b) relief for old cars; (c) abatement or exemption where cars are used for public work; and (d) modification of the proposed taxes on motor cycles and the rejection of the horse-power basis for this class of vehicle.

In the House of Commons recently the Chancellor of the Exchequer was asked to announce the nature of the exemptions under the new taxation of motor cars, and the conditions attaching thereto, especially vehicles used for purely commercial purposes. Mr. McKenna replied:—It is not proposed to interfere with the existing exemptions. These are as follow:—Trade cars, fire engines, motor cars used by a local authority for fire brigade purposes, ambulances, and cars brought into the United Kingdom by a person making only a temporary stay are totally exempt. Motor vehicles kept by a duly qualified medical practitioner for the purposes of his profession are chargeable with one-half of the duty. I am considering whether it is possible to extend exemption to cars used exclusively for public purposes.

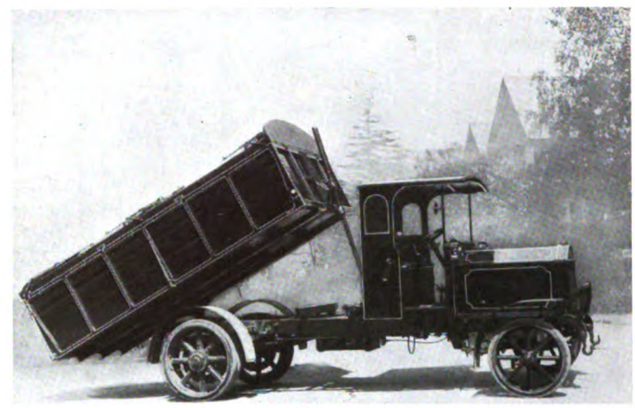
FLEET STREET MOTOR CENSUS.

The tenth annual census of motor traffic in Fleet Street, London, was carried out on April 19 by *Motor Traction*. The results published in our contemporary on May 24, show that 2,643 omnibuses passed in both directions during the day, being a decrease of 101 as against last year, and a fall of 908 from the record figures of 1914. On the other hand, motor trade vehicles show a further notable advance, the number being 468, as against 360 for 1915, and 189 for 1914. As compared with a total of 62 for 1911, industrial motor vehicles in this area have increased over 650 per cent. For the first time mechanical traction exceeded 50 per cent. of the total traffic counted. Nine years ago it represented only about 11 per cent. There was a decrease of about 1 per cent. in the number of vehicles of all kinds as compared with the last census before the war. Military needs occasioned a fall of 313 in motor cabs since the last census, when those vehicles numbered 1,691. Private cars had fallen from 236 to 165. A horse omnibus has not been seen in Fleet Street since 1911.

OXFORD OMNIBUS COMPANY SUED FOR EXTRAORDINARY DAMAGE.—In the King's Bench Division on May 9 counsel for Abingdon Rural Council applied for postponement of the hearing of their action against the City of Oxford Electric Tramways Company for damages caused by the extraordinary traffic of motor omnibuses. Counsel said it was necessary to prove the number of omnibuses. Plaintiffs had not been able to get the information from the time tables, and so it would have to be obtained by interrogatories. Mr. Justice Scrutton directed the case to stand over, with liberty to apply.

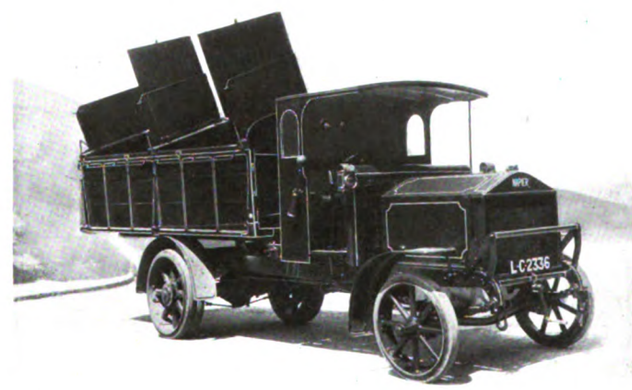
NAPIER CHASSIS FOR DUST VANS.

The two 3½-ton Napier chassis illustrated below have recently been supplied by Messrs. Chalmers and Company, of Redhill, the agents of D. Napier and Son, Limited, to the Royal Borough of Kensington. The body is one of Messrs. Chalmers and Company's patent dust van bodies. The frame is of the best seasoned timber; all ironwork and tipping plates being of steel. A telescopic screw



Chalmers' Patent Body on Napier Chassis.

is fitted, so that the van will tip up and enable all refuse to be discharged; two lids are fitted on each side of the roof, and are made to open separately and automatically, and steel wind shields are fitted to obviate the blowing about of refuse when it is discharged into the body, which is an excellent contrivance from a sanitary point of view. The screw and tipping is made so that the body is easily detachable from the chassis; the driving cab is a fixture, and goes well over the seat. The machines are of a very useful



Steel Wind Shields of the Napier Dust Van.

type, and at the present time should be particularly serviceable to the borough in carrying out their work, owing to the shortage of men. The Corporation already possess a 3½-ton Napier, which, we understand, is giving the utmost satisfaction.

AMERICAN MOTOR VEHICLES FOR INDIA.—The Washington correspondent of the *Mysore Economic Journal* reports that the motor vehicle manufacturers in several States of North America have combined to send six smart travellers to push their goods of every description in the principal cities of India.

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STRAKER FIVE-TON WAGON.

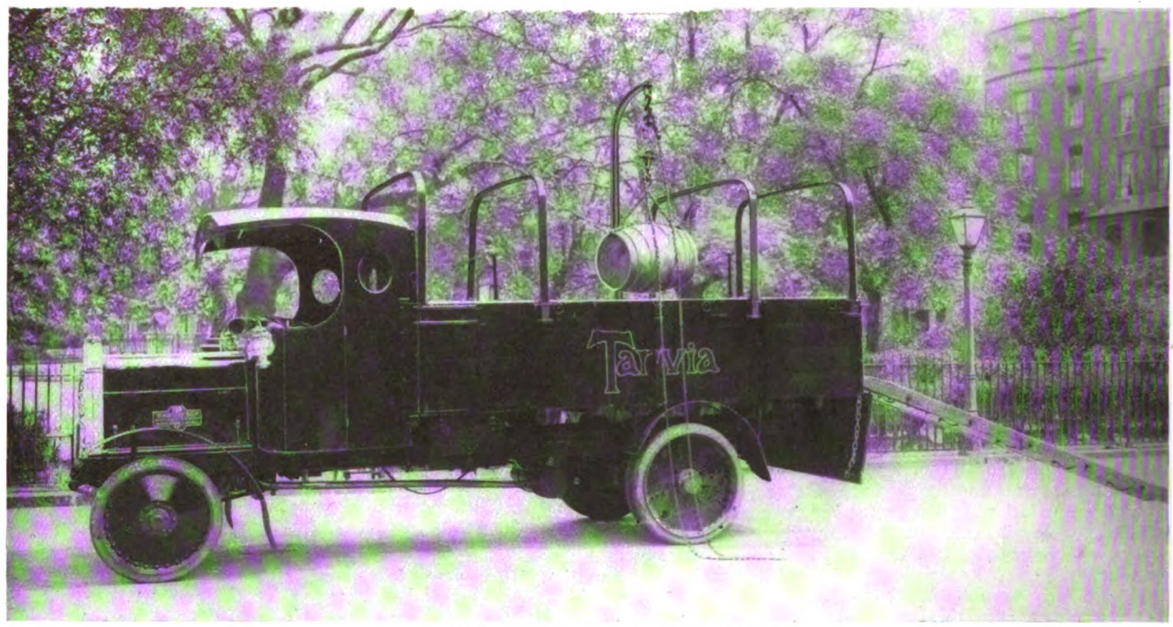
The 5-ton "Straker" wagon illustrated below has just been delivered to Messrs. Bristow and Company, of Tothill Street, Westminster. It is specially fitted for handling tar barrels. The body, which is self-contained, is provided with detachable hoop-sticks for carrying the tarpaulin cover. These are fitted into sockets on the sides, an additional long socket being provided at the front end of the body, into which all the hoop sticks can be placed when it is desired to remove them for loading. Detachable stanchions are also fitted in order to carry chains, which allow several extra tiers of empty barrels to be carried above the sides of the body.

An important feature in the equipment of the wagon is the detachable jib crane, which can be fitted into sockets on either side of the wagon for the purpose of loading or unloading. As will be seen from the illustration, a small pulley block is attached to the end of the jib, so that by means of the block chains the driver is able to raise and lower the heaviest tonnage by himself, thereby being independent of outside assistance.

The body is mounted upon the Straker-Squire "CO 6" model chassis, which has a normal carrying capacity of five tons, exclusive of the weight of the body and equipment. The overall length of the chassis is 20 ft. 1 in., and it is fitted with a 45-H.P. engine. The cylinders are cast in pairs 120 mm. bore by 140 mm. stroke. All the valves are interchangeable, and are located on the same side of the cylinders, being operated by one cam shaft. The crank case is so arranged that the bottom part can be dropped without interfering with the crank shaft bearings, of which there are three. The lubrication is entirely automatic; a pressure gauge on the dashboard gives the pressure of oil in the system, and also indicates its correct working. Control of the engine speed is given by means of a governor in conjunction with a foot pedal, which acts on the engine throttle. A small lever is fitted to the dashboard for setting the engine at a low speed, all acceleration being then controlled by the foot pedal. An efficient cooling system is maintained by means of a centrifugal pump driven by helical wheels. The radiator, of the gilled tube type, is designed to be easily dismantled for examination or repairs.

The gear-box provides four speeds forward and a reverse, the direct drive being on the top speed. The ratio between top and bottom speed is four to one, all speeds being operated by a single lever working in a gate situated at the driver's right hand. The transmission from gear-box to back axle is by cardan shaft to a live axle specially designed to carry its load. The drive is transmitted through two shafts direct to the road wheels, which rotate upon the stationary axle at the ends of the tubular arms; thus the shafts do the driving only, and carry no portion of the weight of the vehicle or its load.

An important feature in the design of this model is the fact that special attention has been paid to accessibility, so that any working part can be readily examined and taken down for repairs or renewal without disturbing other parts of the chassis.



Straker 5-Ton Wagon with Hoisting Gear.

MOTOR OMNIBUS RESTRICTION.

The House of Lords on May 9 agreed to the amendments which the Commons made in the new clause inserted in the Local Government (Emergency Provisions) Bill in Committee in the House of Lords. The object of the clause was to prevent omnibuses and chars-a-bancs plying, without the consent of the highway authority, on any route which had not been regularly used within one year prior to March last. The Commons made the period two years. A report of the proceedings in the two Houses was published in our issue dated May 11.

Mr. R. S. Tilling, speaking from the chair at the annual meeting of Thomas Tilling, Ltd., on May 10, said:—I should like to correct some statements I have seen in the public Press to the effect that the motor omnibus pays nothing in taxes. As a matter of fact, with the 3d. per gallon duty on petrol, the licenses, etc., the contribution amounts to more than ½d. per mile. This sum, if applied to the upkeep of the roads, would more than cover the most extravagant estimate of the extra wear caused by a motor omnibus. The contention of some of the road authorities that the traffic should be made to fit the road, and not the road to fit the traffic, is a most retrograde idea, and if this had been adopted in the past it would mean that we should be still using sedan chairs and saddle horses. Again, to put an extra tax on the vehicle which carries passengers and exempt the one that carries goods is most illogical.

Under the Local Government (Emergency Powers) Act the Croydon Corporation have passed the following resolution:—"The use by any omnibus of any route that has not been used within two years prior to March 1, 1916, without the consent of the Corporation, or, if unreasonably withheld, of the Local Government Board, is forbidden under penalties."

Southend Council are considering the question of placing restrictions on omnibuses serving Leigh and outlying localities.

COLLAPSIBLE HOOD FOR OMNIBUSES.—A new illustrated catalogue of the Beck patent collapsible hood for motor omnibuses and other vehicles has been issued by the Willesden Paper and Canvas Works, Limited. A feature of the publication is that it reveals the simple and effective manner in which Mr. F. Beck, the patentee and manufacturer of the hood, has met our objection that the hood, when lowered, obstructed the front destination board. This drawback has been overcome by advancing the front board and moving the front seat on either side four inches towards the centre. The space thus provided at the sides accommodates the hinges of the framework, while the hood, when collapsed, rests between the advertisement board and the front barrier of the top deck. When closed the hood is thus entirely hidden from view. Another advantage is that the alteration gives additional space for advertisements upon what is the most prominent portion of the vehicle, namely, the side space immediately over the driver's canopy. Mr. Beck is deserving of congratulation upon the perseverance he has shown in perfecting an appliance that will have the effect of increasing earnings.

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MOTOR TRAFFIC.

THE USE OF PRIVATE CARS.

The evidence that has been collected by the Royal Automobile Associated Clubs shows that motoring for purely pleasure purposes has practically ceased. At least 100,000 cars have been used for war work during the last twelve months, almost entirely in a voluntary capacity. The work undertaken included the taking of wounded soldiers, at all hours, to and from railway stations, hospitals, entertainments, and for pleasure rides; assisting the police; driving military officers in the performance of their duties; assisting recruiting; taking helpers and supplies to and from Y.M.C.A. huts, munitions buffets, etc.; and generally giving any help the authorities desired.

Car owners have carried no less than 1,020,300 wounded sailors and soldiers up to April last from trains to hospitals, or between hospitals, and in doing so have driven their cars 4,591,650 miles. This work alone has represented a cost to themselves and a saving to the country of about £114,790, and, further, an actual revenue to the country of £7,650 in the tax paid on the petrol consumed. This excludes all consideration of pleasure rides given to convalescent soldiers, which far exceed these figures.

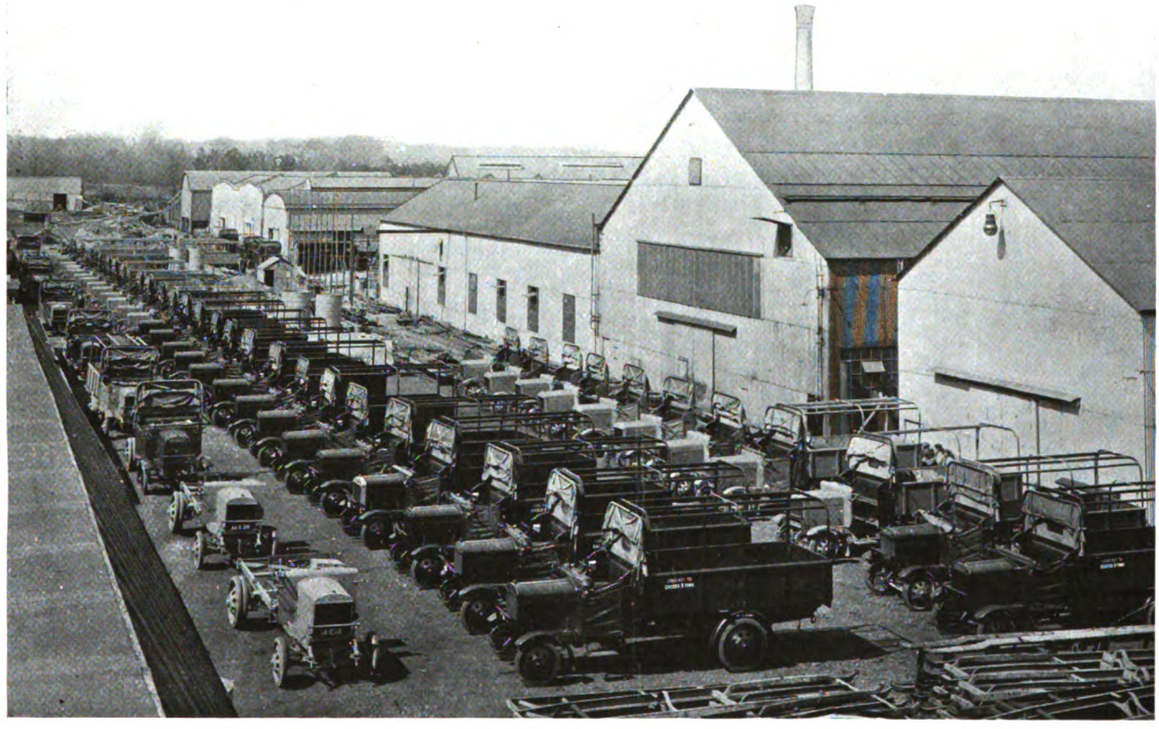
The county surveyors are practically unanimous that the use of private motor cars is much less than in normal times, but that the volume of motor traffic upon the roads has greatly increased, due to the additional commercial vehicles and the military traffic. The county directors of the Territorial V.A.D. organisations have supplied reports of the assistance given to the British Red Cross Society. Great activity by car owners is indicated by the reports of the work of the specially organised bodies to assist in war work. The fact that trade consequent upon purely pleasure driving at the present time is practically non-existent, is emphasised in the reports received from garages and traders.

Bradford Council contemplate purchasing a third motor gulley emptying machine. Besides doing the work at great speed and inoffensiveness, the machines effect a saving of 90 per cent. in repairs caused by gullies becoming choked. The Corporation are likely to place an order for several motor road sweepers when national needs permit the machines to become obtainable.

THORNYCROFT LORRIES AWAITING DELIVERY.

Messrs. John I. Thornycroft and Company, Limited, of Caxton House, Westminster, S.W., in their inland and seaport works, have long specialised in the construction of commercial motor vehicles and marine motor craft. In the former department they were foremost in meeting the requirements of the War Office by providing a type of vehicle for which a Government subsidy was given to the purchaser, conditional upon the machine being placed at the service of the nation in a time of emergency. It is not surprising therefore to find that the naval and military authorities have made large demands upon the products of the Thornycroft works during the past nineteen months, and that orders have also been received through the War Office for the Dominion and Colonial Governments, notably for the Commonwealth of Australia.

The class of vehicle is the 40-h.p. type "J" 3 to 4 ton lorry, which has greatly enhanced its reputation as the result of the severe service to which it has been put both in the war area and for heavy work in munition and military training areas in this country. It is the standard type produced at the Thornycroft works, and long before the war it had gained a name for reliability under the trying conditions of Colonial use.



A Fleet of 40-h.p. Lorries at Thornycroft and Company's Works.

An idea of the great output of this type by one of the Thornycroft establishments will be gathered from the photograph reproduced on this page, showing a large fleet of 40-h.p. type "J" 3 to 4 ton lorries awaiting delivery.

MOTOR COMPANIES' DIVIDENDS.

Belsize Motors, Limited.—An interim dividend of 4 per cent. is announced on the ordinary shares.

Fiat Motors.—The net profits for the past year were £6,854, and £5,974 was brought forward. A dividend of 1s. 6d. per share is proposed, carrying forward £8,185.

John I. Thornycroft and Company, Limited.—On account of the financial year ending on July 31 next the directors announce a dividend of 3 per cent. on the preference shares and 1s. 6d. per share on the ordinary shares, less income-tax.

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MOTOR TRAFFIC.

PETROL SUPPLIES TO BE REGULATED.

COMPULSORY CENSUS OF MOTOR VEHICLES AND FUEL.

On June 1 the Privy Council issued the following regulation under the Defence of the Realm Act in order to provide for a census of petrol supplies :—

Every person who uses or keeps motor spirit, whether for the purpose of supplying motive power to motor cars or for any other purpose, shall supply such information in relation to the motor spirit used or kept by him, and the purposes for which and the manner in which it is used or kept by him, as the Board of Trade may by any general or special order require, giving such particulars in such form and at such times as the Board of Trade may by order direct ; and if any person fails to comply with this regulation, or with any order made by the Board of Trade thereunder, or knowingly gives any false information, he shall be guilty of a summary offence against these regulations.

For the purposes of this regulation, motor spirit has the same meaning as in section 84 of the Finance (1909-10) Act, 1910.

THE FORTHCOMING CENSUS.

The Petrol Committee of the Board of Trade on June 2 issued a notice that it is their intention shortly to take a census of motor vehicles and of petrol consumption and requirements. In the meantime a sub-committee, consisting of representatives of the chief distributing organisations, have undertaken at the request of the committee to regulate the supply of petrol according to the classification shown below. The items in each class are arranged in alphabetical order. It is not anticipated that there need be any curtailment at present of reasonable demands in Classes A and B.

ORDER OF PRIORITY FOR THE DISTRIBUTION OF MOTOR SPIRIT.

Class A includes requirements for or by carriage of munitions of war or materials for munitions of war ; fire brigades and ambulances ; Lords Lieutenant, High Sheriffs, and any services certified by a Government department to be essential ; medical practitioners ; motor cars used by or under the authority of the Red Cross Society or the St. John Ambulance Association or any other society approved by the Admiralty or Army Council for the conveyance of wounded or sick members of any of His Majesty's forces ; police and local government authorities ; veterinary surgeons.

Class B includes requirements for or by agricultural machinery ; aircraft ; conveyance of goods ; industrial processes ; motor cabs plying for hire ; motor cars used by commercial travellers for business purposes ; motor fishing, cargo, and passenger boats other than boats running pleasure services ; motor omnibuses, excepting those running pleasure services ; railway companies ; stationary engines (including lighting sets).

Class C includes all requirements not covered by Class A or Class B, such as chars-a-bancs and other passenger vehicles running pleasure services ; motor boats running pleasure services ; motor cars standing for hire in garages, livery stables, hotels, etc.; private motor cars and motor cycles in ordinary use.

WARNING AGAINST ILLEGAL STORAGE OF SPIRIT.

A statement was published by the Petrol Committee of the Board of Trade on June 2 drawing the attention of owners of motor vehicles and other users of motor spirit to Section 7 of the Petroleum Act, 1871, and to the Regulations dated July 31, 1907, made by the Secretary of State under Section 5 of the Locomotives on Highways Act, 1896, which limit the amount of motor spirit that may be stored without a licence. The committee have received information that in certain cases a quantity of motor spirit in excess of the prescribed amount has been stored, and they wish to impress on users of motor spirit the fact that contravention of the above section and regulations renders the offender liable to heavy penalties.

THE SUPPLY OF COMMERCIAL VEHICLES.

STATEMENT BY THE MINISTER OF MUNITIONS.

Mr. MacVeigh, M.P., on May 23, asked the President of the Board of Trade whether he is aware that motor manufacturers in this country, while supplying the Government with commercial vehicles on the basis of supplies being stopped at six weeks' notice, are under restrictions as to the sale of the surplus material thus left on their hands ; whether he is aware that foreign firms are not placed under any such restrictions ; and whether steps will at once be taken to remove the penalising restrictions so as to leave the home manufacturer unfettered as to the surplus ?

The reply was given by the Minister of Munitions (Mr. Lloyd George) as appended :—The answer to the first part of the hon. member's question is in the affirmative. In the case of firms whose output is controlled, the surplus of commercial motor vehicles, after the war requirements of the Government have been supplied, is available for private customers, subject to the approval of the War Office or the Ministry of Munitions, who endeavour to arrange that commercial motor vehicles shall be released to applicant firms in their order of importance for munition and national purposes. The suggestion made in the latter part of the question will be considered, but owing to the many important issues involved, it is not possible to give any undertaking at present.

BOURNEMOUTH OMNIBUS SERVICES.

In his report on the working of the tramways department for 1915-16, Mr. I. Bulfin, the general manager, makes the following reference to the motor omnibus services : —" The omnibus from Westbourne Arcade to Alum Chine has been in service the whole year, the total receipts for which amount to £503 18s., the passengers carried 72,531, the car-miles run 13,529, the receipts working out at 8·93d. per omnibus mile.

" The omnibus from Boscombe Arcade to Boscombe Pier was run from April 2 to October 2. The receipts amounted to £409 5s. 3d., passengers carried 98,223, car-miles run 7,439, the receipts working out at 13·20d. per omnibus mile.

" The omnibus from Cemetery to Queen's Park Avenue and Markham Road was in service from May 22 to July 30 ; the receipts amounted to £71 11s. 11d., passengers carried 17,183, and the car-miles run 6,142. The receipts only averaged 2·79d. per omnibus mile. Acting on your instructions this omnibus was withdrawn, and placed from August 1 to August 25 on the Square and Pier route. During this period the receipts amounted to £43 19s. 5d., the passengers carried to 10,553, the car-miles run 1,147, and the receipts per omnibus mile to 9·19d. Owing, however, to the very heavy reduction in staff, it was found impossible to continue this omnibus in service. I have still no doubt that this route, if properly nursed, would equal the Boscombe Arcade to Pier route.

" The total running expenses of all the omnibuses amounted to £1,151 17s. 8d., and the total receipts to £1,035 6s. 5d., leaving a deficit of £116 11s. 3d., to be met by the tramways.

" During the winter months a lorry body has been fitted and fixed to one of the omnibus chassis, and has been used for carting purposes in the district. It has proved very satisfactory."

REFUSAL OF LICENCES AT BRIGHTON.

It will be remembered that in January last Messrs. Thomas Tilling, Limited, applied to the King's Bench Division for a rule nisi against the Brighton Corporation directing them to show cause why they should not hear and determine an application for licences for omnibuses, on the ground that the Corporation had not properly exercised their discretion under the Town Police Clauses Act, 1847. The court, presided over by the Lord Chief Justice, refused the application, on the ground that the Council had been guided by the opinion of the Chief Constable, and had not therefore acted from bias.

Messrs. Tilling have since applied for licences to ply for hire with fourteen omnibuses, the application being supported by a memorial signed by 12,000 persons, although there is a company already operating motor omnibuses. The Watch Committee have recommended the Council not to grant the application, as the Chief Constable has reported that he objects to the licensing of competing omnibuses.

The Council decided to defer their decision until the June meeting, in consequence of the receipt of a joint letter from Messrs. Tillings and the Brighton and Hove Omnibus Company, asking for a postponement to enable the two companies to hold a conference.

THE DUPLICATION OF LONDON SERVICES.—Replying to a question addressed to him in the House of Commons on May 31, Mr. Hayes Fisher, Parliamentary Secretary of the Local Government Board, said no decision had yet been reached by the conference between the County Council and the London General Omnibus Company on the avoidance of waste owing to the duplication of passenger services in London.

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MOTOR TRAFFIC.

THOMAS TILLING, LIMITED.

The report for the year ended December 31 last shows a profit of £83,392. Adding the amount brought forward, £17,186, there is a sum of £100,578. Interest on debentures and income debenture stock requires £14,000; interim dividend on preference shares, £8,250; reserve fund to cover decline in market values of investments, £594. The directors recommend a dividend of 12 per cent., less income-tax, on the ordinary shares. This will entitle the income debenture stockholders to additional interest at the rate of 1⅛ per cent. for the year, leaving the sum of £49,434 to be carried forward. The directors have considered it advisable to carry forward a larger sum than usual in view of the difficulties of trading at the present time, and the uncertainty with regard to taxation. The price of many of the commodities used in the business have been abnormally high during the year, thus rendering some portions of the undertaking unprofitable, but the directors feel confident that the shareholders will be satisfied with the result of the year's trading considering the difficulties of the present circumstances.

At the annual meeting on May 10, Mr. R. S. Tilling, the chairman, said that the net results of the year's trading had been quite satisfactory, and they had been able to justify the statement made three years ago, when they issued the income debenture stock, that the fresh capital would enable them to pay a higher dividend. The year 1915 was the first complete twelve months during which the full effect of that issue was felt. One section of the business—the horse part—had, however, been quite unprofitable; forage of all descriptions had continually advanced in price; labour, horse renewals, shoeing, etc., had increased likewise. There was a time not long ago when the horse side helped the mechanical to get on its feet, and now it was the mechanical side which had helped the horse. This company were the pioneers in the employment of women conductors in London, and the experiment had been quite successful. They were paying the women at the same rate as they paid the men. The public liked the innovation, as the women were intelligent and attentive. They had lately built a large garage at Croydon, especially fitted for the employment of women labour. After a reference to the question of the motor omnibus and taxation (which is given in another column), the Chairman mentioned that several of their works were now under Government control for war purposes. Nearly 800 of their men had voluntarily enlisted. Replying to a vote of thanks to the directors, the chairman said that the past year was his fiftieth year in the business, and it was the most successful they had experienced.

OMNIBUSES AND ROAD MAINTENANCE.

Recently Sheffield tramways department extended their motor omnibus service to Eckington for the convenience of munition workers, although it is stated that the Corporation do not possess powers to run to that locality. The sum of ⅜d. per car mile is paid to the County Council for road maintenance, which is equivalent to a sum of £120 per annum, whereas it is estimated that an outlay of between £1,000 and £1,200 per mile will be necessary to repair the roads. The County Council has disregarded the request of the Parish Council that no obstacle should be placed in the way of the extended service.

The London General Omnibus Company have renewed their application to Romford Council for sanction to running their vehicles in that authority's area. The surveyor reported that an outlay of £4,000 would be necessary to fit the roads for such traffic, and he advised that the question should be deferred for a year. The Council declined to accede to the application, and appointed a committee to inquire as to the feasibility of running their own omnibus service.

Epping Rural Council have asked the Local Government Board to receive a deputation to urge the restriction of the use of the country roads by omnibuses, especially on Sundays, in view of the great cost for road repair, and also the use of motor spirit. On Sundays about 300 omnibuses visit Chigwell.

ELECTRICAL AND PETROL-DRIVEN TOWER WAGONS.—Hull Tramways Committee have considered quotations and particulars obtained for the supply of electrical and petrol-driven motor tower wagons. The tramways engineer suggested that before arriving at a decision the vehicles at present in use by other tramway undertakings should be inspected, and the committee left the matter in the hands of the chairman and deputy chairman.

SOCIETY OF MOTOR MANUFACTURERS AND TRADERS.

Mr. E. Powell has been re-elected President of the Council of the above society for the ensuing year. The following gentlemen have been elected to the Council, the asterisk denoting members of the Management Committee:—

Vice-Presidents:—

*A. Brown, Brown Bros. *E. Hopwood, Wolseley Motors.

J. H. Adams	Belsize Motors.
*A. R. Atkey	Agents' Section.
R. D'Arcy Baker	Fiat Motors.
*S. D. Begbie	Aster Engineering Company (1913).
F. S. Bennett	F. S. Bennett, Limited, Cadillac Motors.
*L. M. Bergin	Dunlop Rubber Company.
W. Bond	St. Helens Cable and Rubber Company.
A. Brampton	Brampton Brothers.
F. Churchill	J. and E. Hall.
*D. Citroen	Minerva Motors.
B. Coathupe	Agents' Section.
A. Craig	Maudslay Motor Company.
R. Dennis	Dennis Bros. (1913).
S. F. Edge	Past President.
*A. Goodwin	C. A. Vandervell and Company.
E. W. Hatfield	Agents' Section.
G. F. Heath	Agents' Section
*H. M. Hobson	H. M. Hobson
W. M. Iliff	Sunbeam Motor Car Company
*E. M. C. Instone	Daimler Company
E. Manville	Past President.
H. Johnson	Joseph Lucas
*F. Lanchester	Lanchester Motor Company.
J. C. Lees	Chas. Macintosh and Company.
*W. M. Letts	Crossley Motors
C. Marston	John Marston.
*J. Maughling	John I. Thornycroft and Company.
F. May	Green Engine Company
*A. S. Mays-Smith	De Launay Belleville Automobiles (England).
*F. Maythorn	Maythorn and Son.
*A. N. Mobbs	Agents' Section.
S. Norris	Agents' Section.
P. L. D. Perry	Ford Motor Company (England).
*T. C. Pullinger	Arrol-Johnston.
J. J. Rawlings	Agents' Section.
J. Graham Reece	J. Blake and Company.
*F. W. Shorland	Clement Talbot.
H. White-Smith	British and Colonial Aeroplane Company.
*H. Smith	Rover Company.
S. Straker	Past President.
*H. C. B. Underdown	Commercial Cars.
H. T. Vane	D. Napier and Son.
L. Walton	Vauxhall Motors.
Rowland Winn	Agents' Section.
G. H. Woods	British Westinghouse Electric and Manufacturing Company.
T. H. Woollen	Palmer Tyre.
W. Peto	Peto and Radford.

WAR OFFICE AND THE L.G.O.C.

NATIONAL SERVICE OF THE COMPANY.

In the House of Commons on May 30, on the order for the third reading of the Consolidated Fund (No. 3) Bill, Mr. Ashley (Blackpool), in calling attention to War Office administration, said that he had been taken to task for his statement about the London General Omnibus Company, but as far as his information went what he said was perfectly true. The proposal made by the company to the War Office at the beginning of the war was, he was told, refused by the Financial Department of the War Office, though it was backed by the Quartermaster-General's Department. The result was that the Government had paid from £600,000 to £750,000 where they might only have paid £170,000 or £200,000.

Mr. Forster (Financial Secretary) replied that Mr. Ashley's information was not altogether accurate. The question whether the London General Omnibus Company's business should be taken over by the Government as the railways had been was thoroughly considered, as was necessary, seeing that a cost of between £1,000,000 and £1,500,000 was contemplated by those who recommended that course. The Quartermaster-General, the then Financial Secretary, and other officials concerned unanimously recommended the arrangement which had been adopted.

We may add that the Government have an arrangement with the company for the use of their vehicles and drivers whenever they may be required by the military authorities in an emergency. The omnibuses have been used for the transport of Belgian refugees and in conveying aliens to the camps in the London district. On the occasion of the sudden decision to send a naval landing force to assist in the defence of Antwerp, the company at a few hours' notice supplied a large number of omnibuses, with drivers fully equipped, when invaluable service was rendered in transporting troops to that city and also during the withdrawal.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

TIRES FOR OMNIBUSES.—Sheffield Tramways Committee have placed a contract with the Dunlop Rubber Company for the supply of tires for motor omnibuses at 0·875d. per mile.

ELECTRIC VEHICLE COMMITTEE.—The Society of Motor Manufacturers and Traders, Limited, have appointed Mr. T. C. Pullinger, of Arrol Johnston, Limited, to represent this society upon the Electric Vehicle Committee.

GLASGOW CORPORATION GARAGE.—The municipal garage maintained by the tramways department for Glasgow Corporation contains twenty motor cars for the use of officials and committees. These are now all driven by women.

ELECTRIC DELIVERY DRAYS.—The Midland Railway Company is experimenting with electric drays for delivering goods in the outlying districts of Sheffield. Three accumulator vehicles are being used, and it is reported that they are giving complete satisfaction.

WORKING COST AT ROTHERHAM.—Owing to the increased charges for materials the working cost of the motor omnibus services of Rotherham tramways department has risen from 7·02d. to 8·92d. per mile. This amount includes sinking fund on the basis of a life of five years.

REVERSION TO HORSE TRACTION IN BERLIN.—In consequence of all the motor omnibuses of the Berlin Omnibus Company having been appropriated by the army, the company have reverted to horse traction. The traffic receipts have fallen from £665,000 in 1913 to £312,000 for 1915.

AN OFFER FOR OLDHAM OMNIBUSES.—A firm at Colwyn Bay offered to hire the omnibuses owned by Oldham Corporation for certain periods of the year. The offer has been refused by the Tramways Committee, and a member stated that if they sold the vehicles it would only be to secure more adaptable ones.

THE PETROL REBATE.—The Commissioners of Customs and Excise have allowed a rebate to Willesden Urban Council of the whole of the petrol tax in respect of spirit used in the Council's cars for conveying children to and from the special schools, and also of wounded soldiers from railway stations to hospitals. The saving will amount to about £60 a year.

CAR ALLOWANCES TO OFFICIALS.—The following scale of allowances to officials of the Nottinghamshire County Council using their own motor cars has been agreed to by the Council:—Sixpence per mile for cars with four or more seats; 4d. per mile for cars with two or three seats; privately owned motor cycles, 2d. per mile (with or without sidecar); the scale not necessarily to apply to present arrangements in use but in all new arrangements.

THE ZENITH CARBURETTER.—With petrol so scarce it is the patriotic duty of all motorists to take every means of conserving it, and therefore the claims of the Zenith carburetter to save from 25 to 50 per cent. are worthy of investigation. A booklet giving details of what has been accomplished on most of the known engines by Zeniths will be sent post free on application to the Zenith Carburetter Company, Limited, 40-42, Newman Street, London, W.

OXFORD OMNIBUS FITTER AND MILITARY SERVICE.—In an appeal by the military authorities at Oxfordshire Appeal Court against the exemption of a motor omnibus fitter employed by Oxford Tramways Company, it was asserted that the man only did the work of a mechanic, but Mr. A. A. Tyler, the manager, gave contrary evidence, and added that the vehicles which the man attended to were placed at the disposal of military hospitals free of cost. While dismissing the appeal the court shortened the period of exemption until November 2.

MOTOR TIRES IMPORTS NOT PROHIBITED.—In a preliminary official list, motor tires and tubes were given as being among the articles the import of which was to be prohibited in order to lessen the demand upon shipping facilities. In the House of Commons on May 9, the President of the Board of Trade stated that the Board had been unable to include motor tires in the list. There were certain arrangements made with the rubber importers in the United States which had led to the decision that this prohibition should be abandoned.

OPERATING COSTS OF MOTOR SWEEPERS.—Among the objects of interest inspected by the Institution of Municipal and County Engineers during their visit to Hull on May 13 were a Weeks' tar spraying apparatus mounted on a Sentinel steam wagon, Whittome's "Royal" sweeper and "Rapid" sweeper, and Green's motor sweepers. Mr. Bricknell, the city engineer, stated that the petrol sweepers cost about £2 2s. a day for everything, including depreciation, tires, and wear, which was considerably less than the working cost of a horse-drawn sweeper.

MOTOR VEHICLES FOR MUNICIPALITIES.

HULL CORPORATION have invited tenders for the provision of a motor ambulance.

SOUTH SHIELDS COUNCIL have arranged to purchase a Leyland motor fire engine, at £1,117.

WORKSOP COUNCIL have directed the surveyor to obtain prices for the supply of a petrol motor wagon.

SOUTH SHIELDS COUNCIL have ordered a motor fire engine from the Leyland Company, Preston, at £1,117.

SOUTHAMPTON TRAMWAYS COMMITTEE have placed an order for an Edison battery automatic tip-wagon, at £950.

HOLMFIRTH COUNCIL are considering the question of purchasing a motor wagon owing to the scarcity of team labour.

WALSALL GAS COMMITTEE have placed a contract with Messrs. Alley and Maclellan, Limited, for the supply of a 3-4 ton steam wagon, at £730.

BRADFORD CLEANSING COMMITTEE on May 9 authorised a subcommittee to purchase three motor chassis if they are satisfied that supplies of petrol will be obtainable.

PLYMOUTH CORPORATION have decided to purchase a 3-ton Edison lorry for the sum of £1,055 for the cartage of coal from the railway station to the electricity works, and for the use of other departments also.

THE LONDON WATER BOARD have consented to an increase of £25 in the contract price of a motor ambulance that Messrs. Dennis Brothers are constructing for them. The addition is to meet the increased cost of labour and materials.

HALIFAX HEALTH COMMITTEE are obtaining information as to the best class of vehicle to use for the collection of house refuse. Owing to the difficulty of obtaining horses, carts, and men the committee have already secured a Yorkshire Commercial steam wagon.

NOTTINGHAMSHIRE COUNTY COUNCIL have agreed to purchase a steam motor wagon from Messrs. Clayton and Shuttleworth, Limited, at £700, in order to carry out work that is being performed for the Government. The Road Board are advancing a loan, free of interest, repayable in five years.

SHEFFIELD TRAMWAYS COMMITTEE have agreed to purchase an additional Daimler omnibus chassis, at £790. The body will be supplied by the department's car shop. Owing to the increase in the number of omnibuses the Committee, at the request of Mr. A. R. Fearnley, the general manager, are considering the question of providing extra garage accommodation.

SALFORD COUNCIL have placed a contract with Thomas Green and Son, Limited, of Leeds, for a Green's motor sweeper, at £614 15s. If at the end of a month's trial the machine proves satisfactory, the Council propose to purchase a second one from the same firm. The Council have accepted the Albion Motor Car Company's tender, at £896, for the supply of an additional 4-ton petrol motor wagon.

HALIFAX TRAMWAYS COMMITTEE have purchased a 3-ton omnibus chassis from the Daimler Company. Three Daimler chassis belonging to the tramways department are being sold for £450 each to the British Automobile Traction Company, London. The borough treasurer has reported that the working of the omnibuses of the department for the year ended March 31 last resulted in a loss of £355, as against a profit of £215 for the preceding year.

MUNICIPAL AND COUNTY ENGINEERS.

Road matters will occupy a large share of the attention of the Institution of Municipal and County Engineers at their annual conference, which is to be held on June 29-30 and July 1 at Blackpool. The papers to be read and discussed will include the following:—"The Destruction of Roads," by Thomas Arnall, Birmingham Corporation. "Improvement of Highways to Meet Modern Conditions of Traffic," by W. H. Scholfield, county surveyor, County Palatine of Lancaster. "Road Signs," by C. H. Cooper, borough engineer and surveyor, Wimbledon. "Transport Reform," by A. E. Gattie, London. "Public Abbatoirs," by H. A. Brown, engineer and surveyor, Weston-super-Mare. "The Diesel Engine in Municipal Work," by F. Reginald Phipps, borough engineer and surveyor, Basingstoke. "Diagrammatic Statistics for Municipal Engineers," by Reg. Brown, engineer and surveyor, Southall-Norwood.

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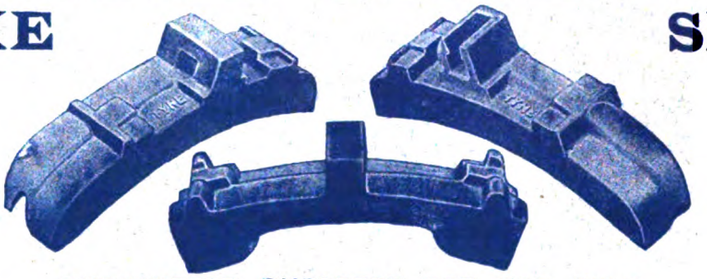

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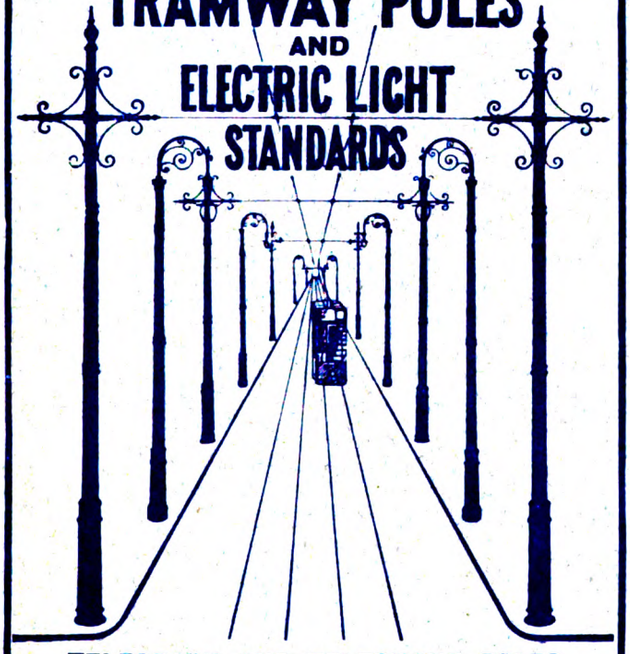

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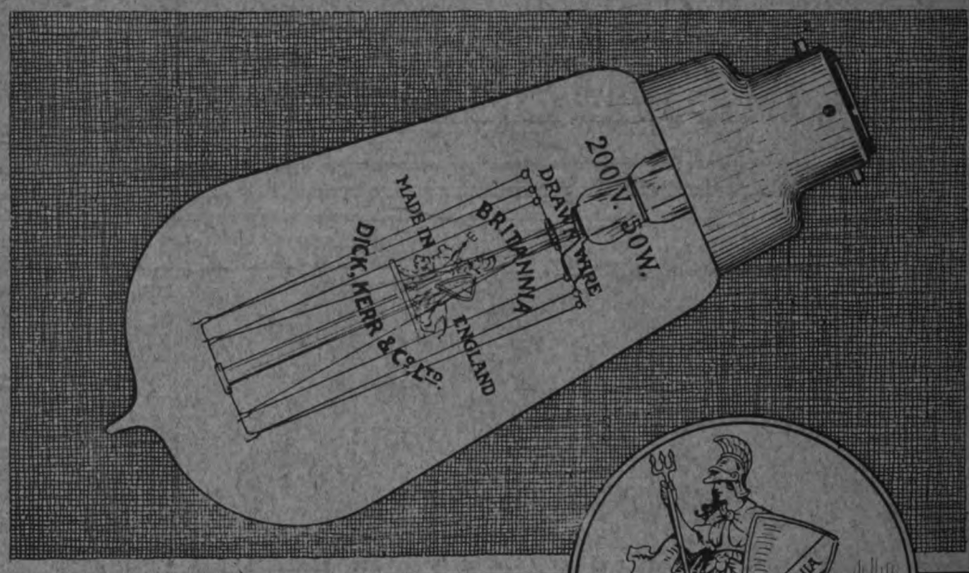

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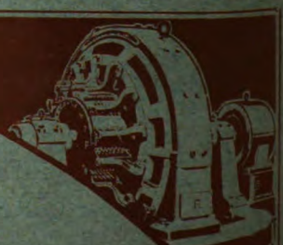

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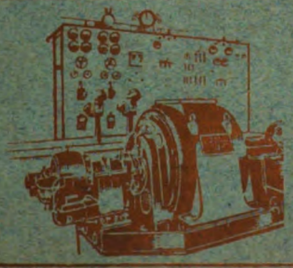

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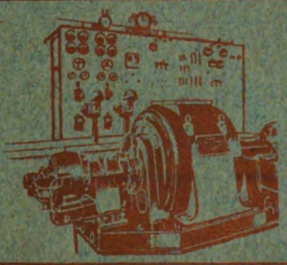

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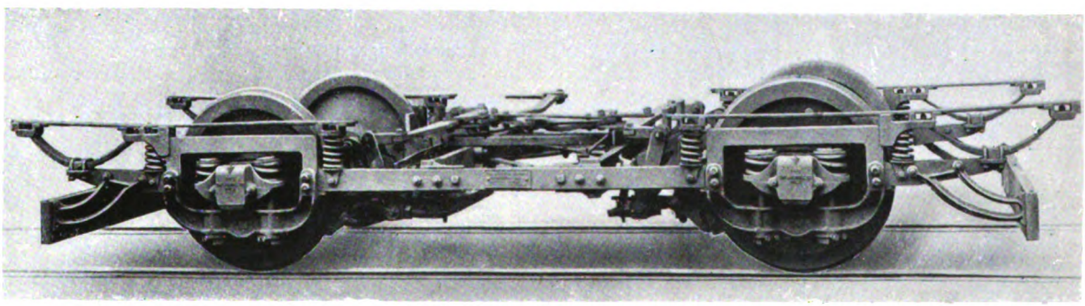

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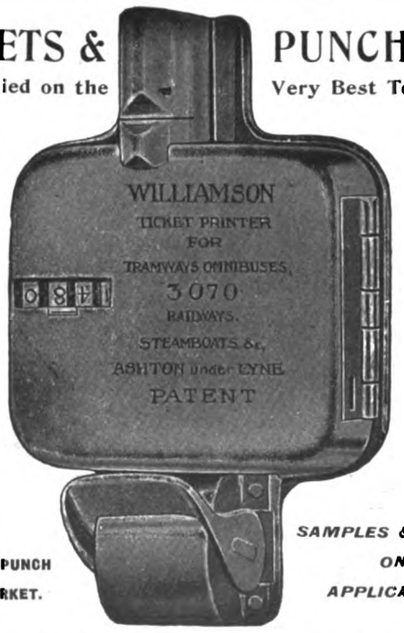

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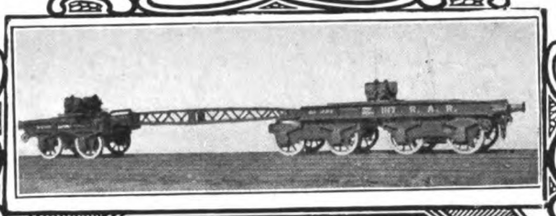

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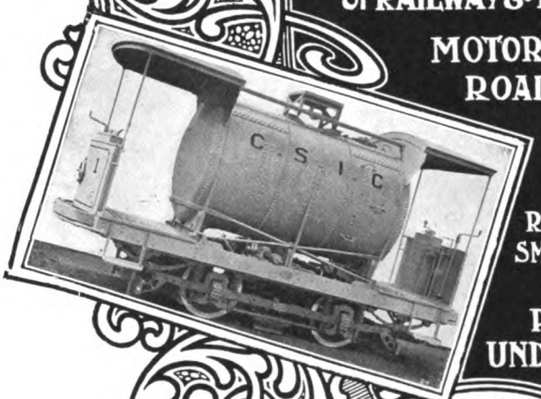

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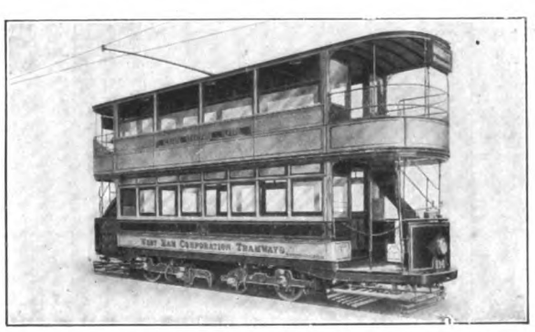

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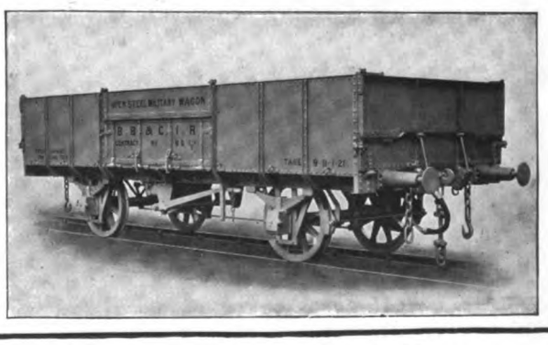

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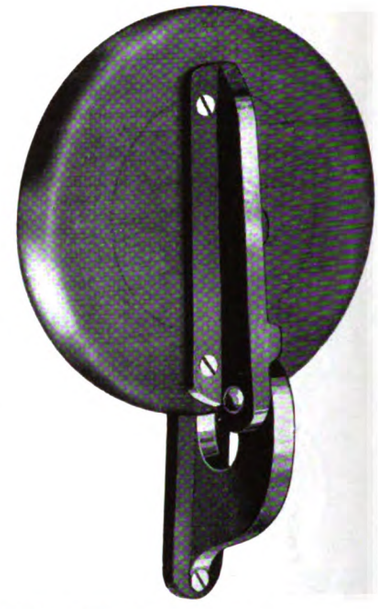

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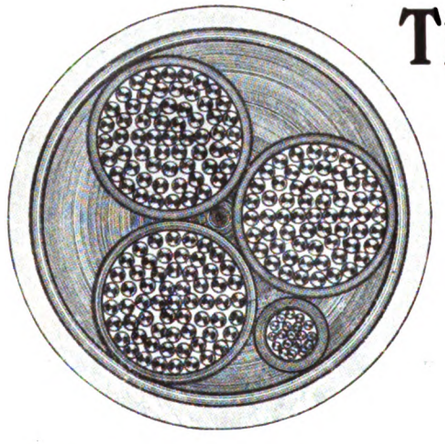

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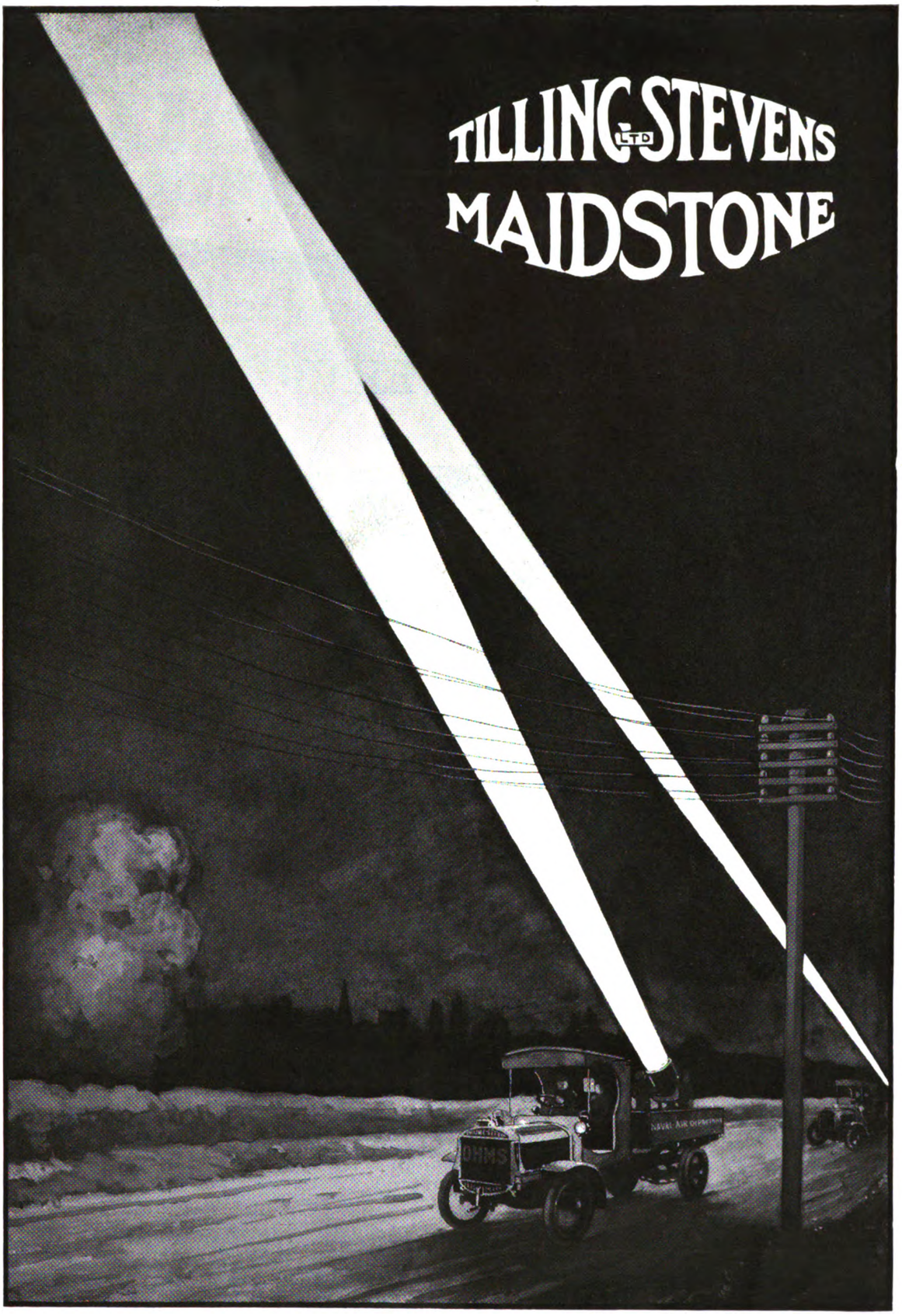

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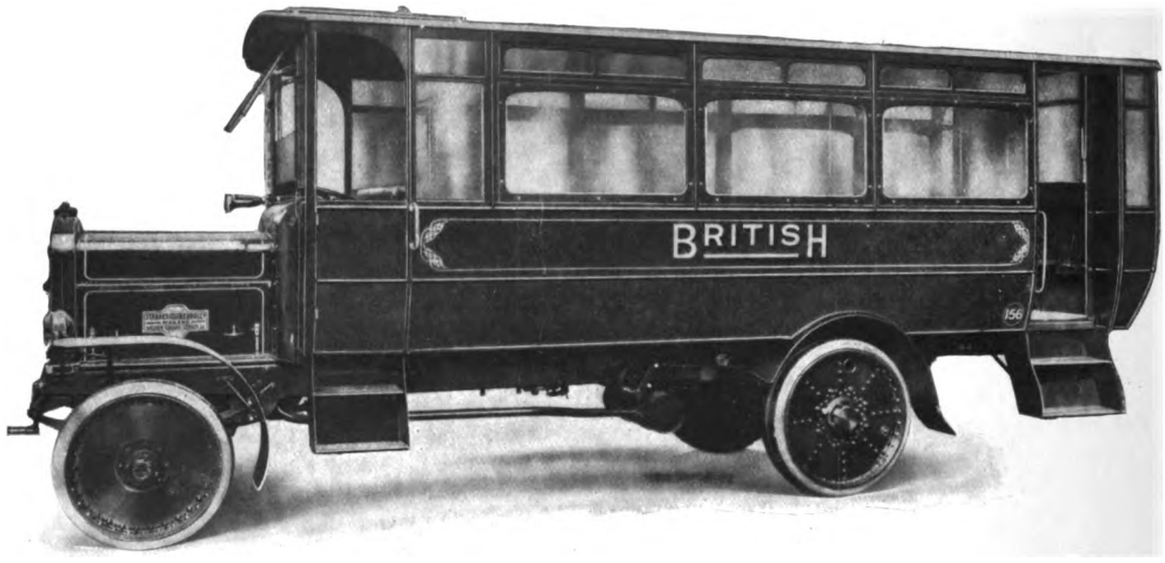

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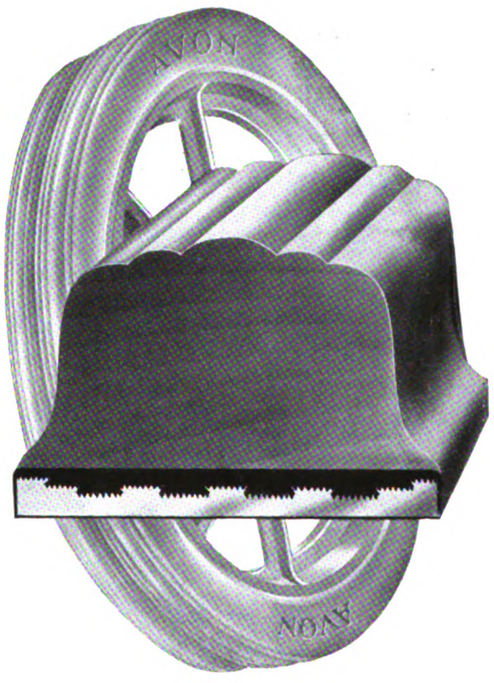

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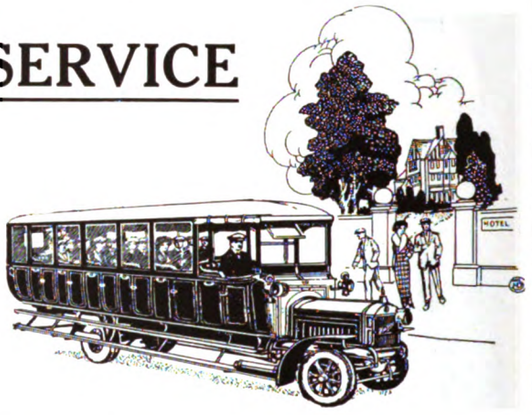

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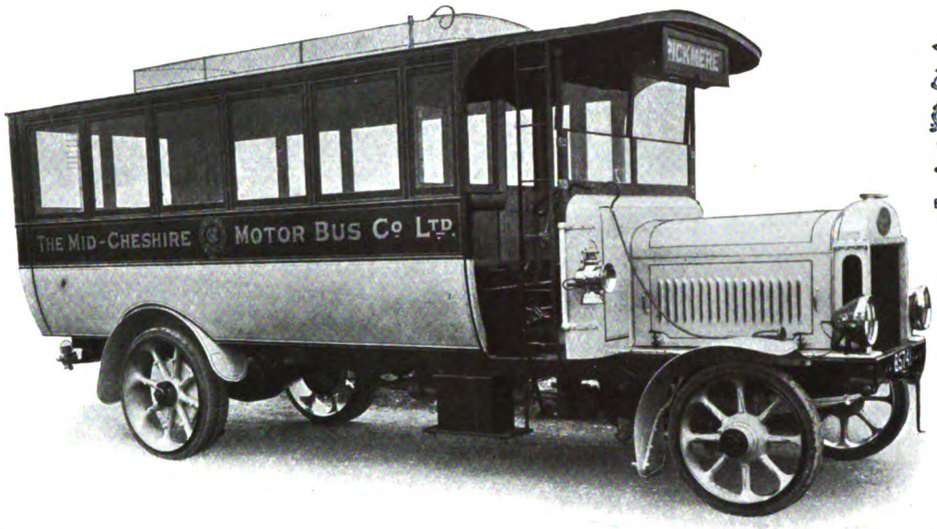

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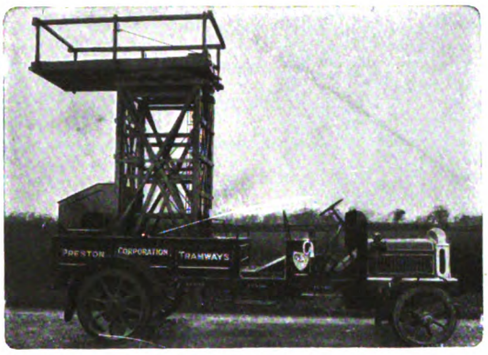

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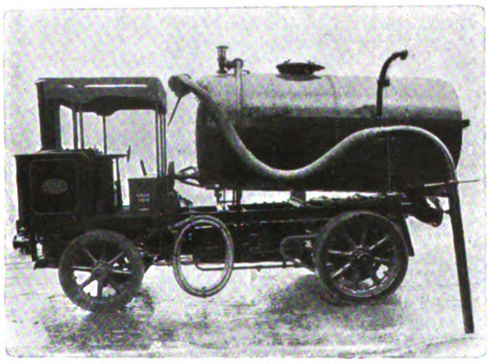

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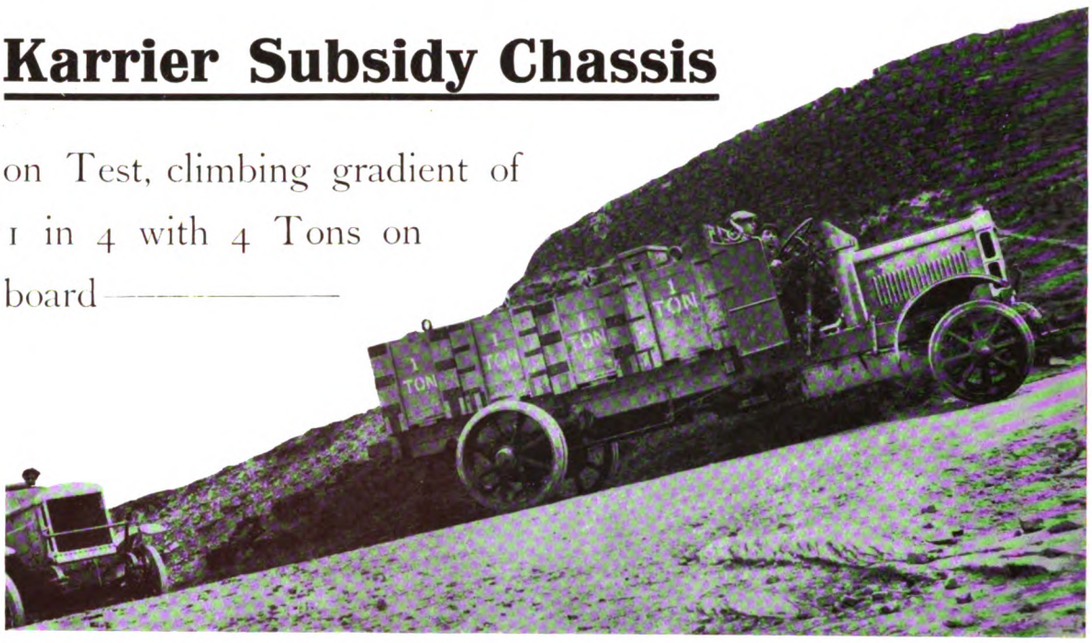

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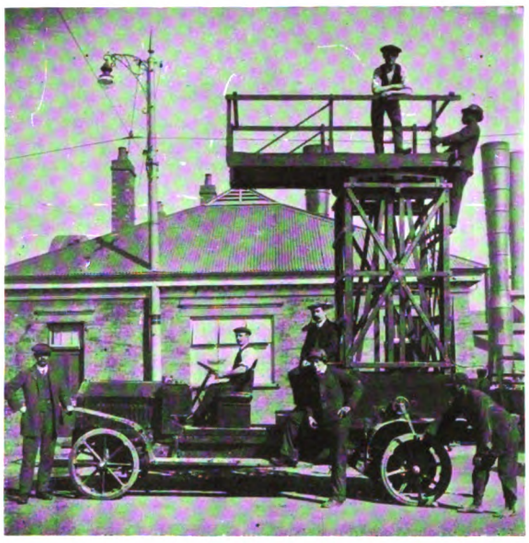

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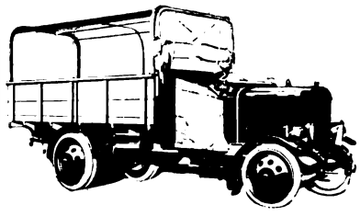

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April 17th 1916.

Messrs Wood Milne Ltd.,
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Dear Sirs,
We herewith have the pleasure to submit you the mileages of the following tyres.

Tyre	Mileage	On	Off
232	10,498	July 13/13	March 2/14
224	10,498	" "	" "
63	14,028	Jan. 16/14	Sept. 14/14
600	14,028	" "	" "
23330	20,668	Apl. 11/15	Feb. 29/16
24090	20,668	" "	" "
24091	17,548	" "	" "
23327	17,548	" "	" "
23901	14,968	June 18/15	" 8/16
23842	14,968	" "	" "
23328	18,088	" "	March 3/16
23329	18,088	" "	" "
23331	18,088	" "	" "
23332	18,088	" "	" "

Yours faithfully,
FOR AND ON BEHALF OF
COMMERCIAL CAR HIRERS LTD
GENERAL MANAGER & SECRETARY.

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AFTER exhaustive tests in which over 2,100 tyres have been under constant observation, we are satisfied that the Goodyear Band Tyre has no equal for all-round economy.

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Low cost per tyre mile is one of the vital features of the Band Tyre ; but it is not everything. A cheap tyre may give low cost per tyre mile while it lasts ; but it may give a small total mileage. On account of its durability the Goodyear Band Tyre will give big mileage combined with low mileage cost.

Then again, durability is not everything. A tyre may be so hard that it will quickly jar your vehicle out of commission ; but the Goodyear Band Tyre, while durable, possesses cushioning qualities that will lengthen the life of your vehicle.

Write to us and we will have our representative call on you. This will not entail any obligation or cost to you.

The
Goodyear Tyre and Rubber Company (Gt. Britain), Ltd.
Dept. "T.W."
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GOODYEAR
BAND TYRES

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— SUPPLIED TO —

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TRIAL

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PRESENT FLEET.

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HENLEY

SOLID BAND TYRES

not only repeatedly outlast the Guarantee, but give all-round satisfaction all the time.

While the mileage guarantee is an assurance of service, it is not necessarily an assurance of satisfaction. Replacement, though better than sheer loss, is not adequate compensation for tyre trouble. Faulty Tyres may put the vehicle out of use for weeks. They may disorganise the whole of a delivery service. They may, directly, and indirectly, cost the purchaser hundreds of pounds.

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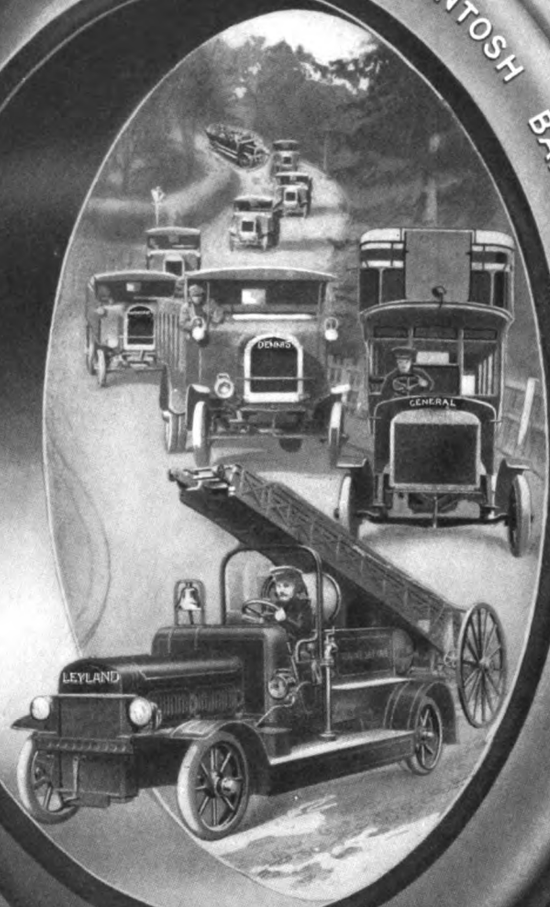

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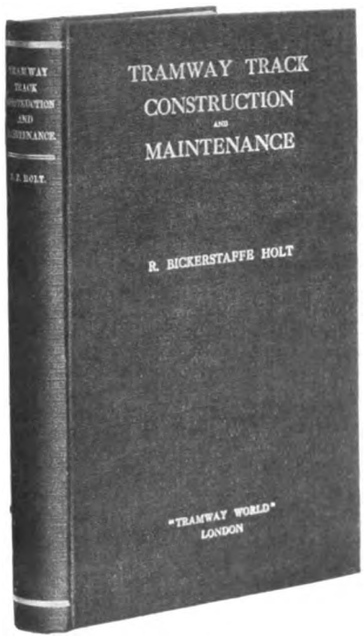

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CONTENTS.

FOREWORD.
"What's wrong with the Track?"

CHAPTER I.—CONCRETE FOUNDATIONS.
Defects—Causes of fracture—Method of laying concrete.

CHAPTER II.—CONCRETE MATERIALS.
Road metal—Water gravel—Sand—Clinker sand—Trass.

CHAPTER III.—REPAIRS TO CONCRETE FOUNDATIONS.
Patching—Partial repairs—Complete renewal.

CHAPTER IV.—TRACK DESIGN.
"Follow my leader" policy—Importance of local conditions—Effect on sub-soil—Standard methods—Transverse sleeper tracks—Effect of vehicular traffic and tramway car traffic.

CHAPTER V.—RAIL PACKING.
Pitch and tar packing—Materials—Testing and preparation of materials—Prepared tar—Pitch mixtures—Movement of rails—Packing and floating.

CHAPTER VI.—RAIL LAYING.
Bad rail packing—Rails canted or twisted—Anchoring and padding—Rail expansion and contraction—Curving of rails—Springing of rails—Anchoring new tracks.

CHAPTER VII.—JOINTS, FISH PLATES, BOLTS AND NUTS.
Why joints fail—Dished or hammered joints—Movement at joints.

CHAPTER VIII.—JOINT WELDING.
Methods of welding—Thermit welding—Electric arc welding process—Expansion and contraction—Oxy-acetylene process.

CHAPTER IX.—RAIL WEAR.
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Causes of rail corrosion—Exposure to sea water—Effect of corrosive liquid.

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CHAPTER XIII.—RECONSTRUCTION.
Removal of tracks—Temporary tracks.

CHAPTER XIV.—SURFACE DRAINAGE AND RAIL MAINTENANCE.
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CHAPTER XV.—SPECIAL TRACK WORK.
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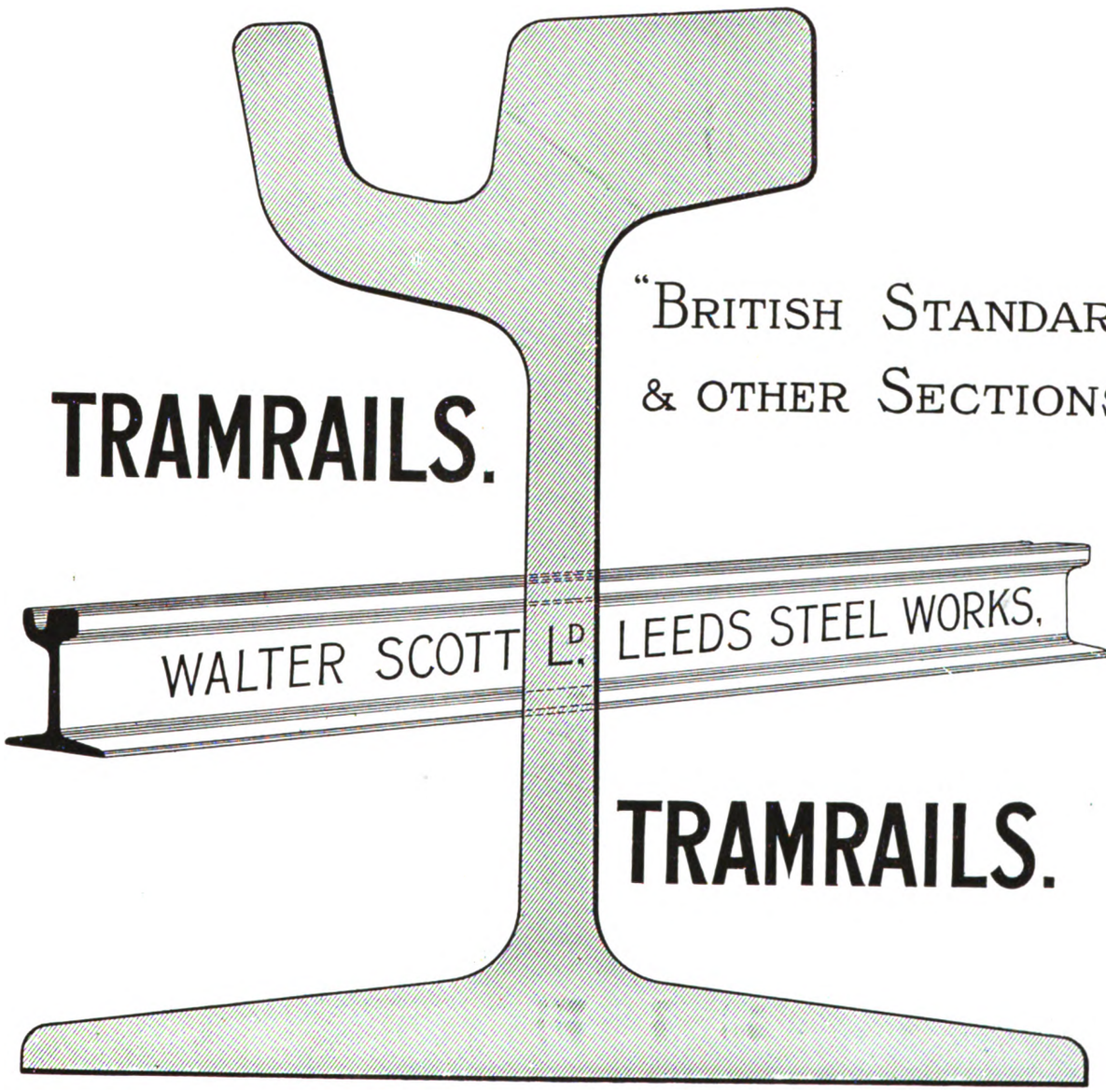

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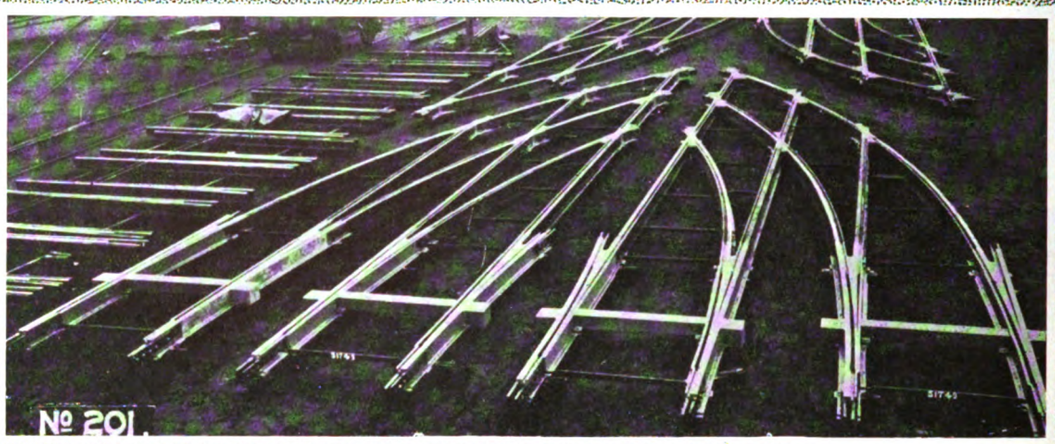

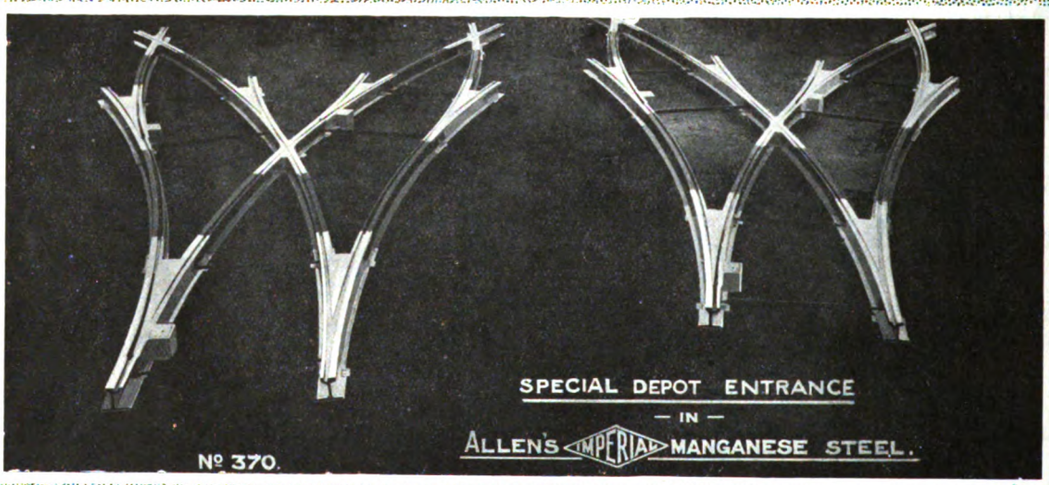

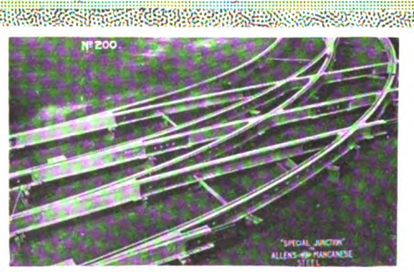

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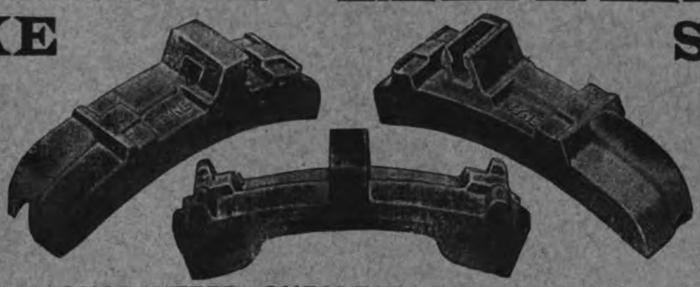

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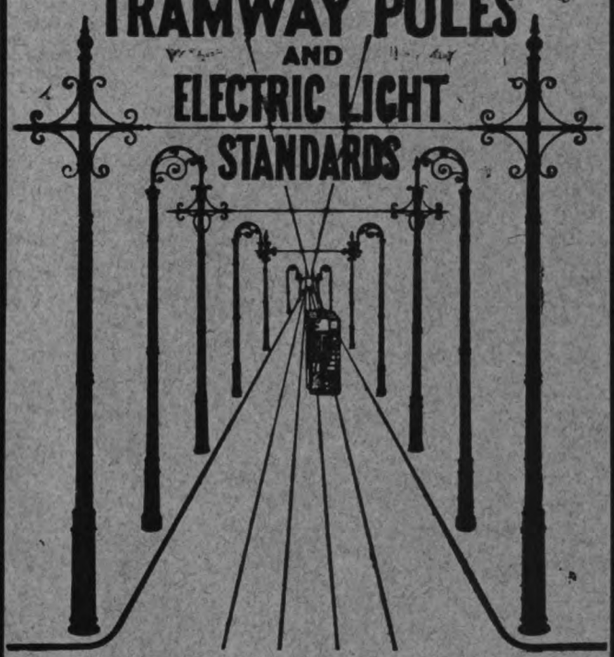

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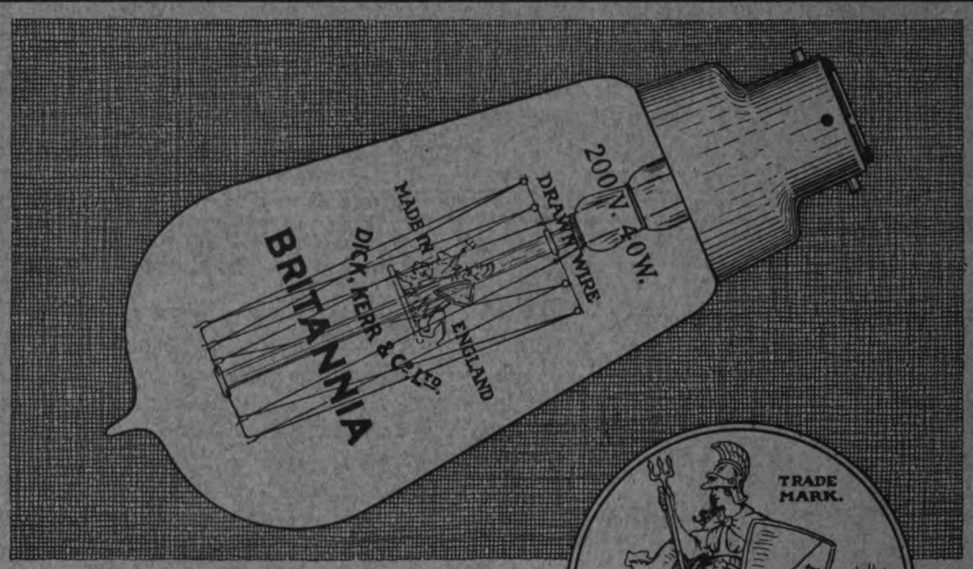

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